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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY.

B. T. GALLOWAY, *Chief of Bureau.*

THE PHILADELPHIA
NOV 21 1912
MUSEUMS.

BULLETINS OF THE BUREAU OF PLANT INDUSTRY NOS. 97 TO 101, INCLUSIVE, 1907.

VOLUME XIII.

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1907.

CONTENTS.

Page.

BULLETIN No. 97.—SEEDS AND PLANTS IMPORTED DURING THE PERIOD FROM DECEMBER, 1903, TO DECEMBER, 1905. INVENTORY No. 11; Nos. 9897 TO 16796.

Introductory statement 5
Inventory of seeds and plants imported 7
Index of common and scientific names 239

BULLETIN No. 98.—SOY BEAN VARIETIES.

Origin and introduction of the soy bean 7
Variability 8
Classification 9
Key to the varieties 11
Descriptions of the varieties 12

Black-seeded group:

Buckshot 12
Nuttall 14
Kingston 15
Ebony 15
Flat King 16
Riceland 16

Brown-seeded group:

Ogemaw 17
Eda 18
Baird 18
Brownie 19

Mottled-seeded group:

Hankow 19
Meyer 20

Green-seeded group:

Samarow 20
Guelph 20

Greenish-yellow-seeded group:

Yosho 21
Haberlandt 22
Tokyo 22

Yellow-seeded group:

Ito San 23
Manhattan 24
Butterball 24
Amherst 25
Hollybrook 25
Mammoth 26
List of synonyms 27
Distribution numbers 27
Description of plates 30

Page.

BULLETIN No. 99.—A QUICK METHOD FOR THE DETERMINATION OF MOISTURE IN GRAIN.

- Quality of export corn 7
- Causes of deterioration 7
- The percentage basis for moisture determinations 8
- Description of a method for the rapid determination of moisture 9
- Preparation of samples for moisture determination 10
  - Taking the bulk sample 10
  - Taking the sample for the moisture test 10
  - Size of sample for the moisture test 11
  - Weighing the sample for the moisture test 11
  - Grinding the grain unnecessary 12
- Oil for the moisture test 12
  - Quality required 12
  - Quantity required 13
- Description of the apparatus 13
  - The evaporating chamber 13
  - The condenser 18
  - The stand supporting the evaporating chamber and condenser 18
  - The distillation flasks 19
  - The thermometers 20
  - The condenser tubes 20
  - The graduated cylinders for collecting and measuring the water 20
- Comparison of results with determinations made in a water oven 21
  - Variations in duplicate tests 22
- Summary 23

BULLETIN No. 100.—MISCELLANEOUS PAPERS.

- Cranberry spraying experiments in 1905 7
  - Introduction 7
  - Spraying and its results 8
  - Importance of early applications 9
  - Effect of spraying plants when in full bloom 10
  - Keeping qualities of sprayed and unsprayed fruit 10
  - Cost and recommendations 11
- The wrapping of apple grafts and its relation to the crown-gall disease 13
  - Introduction 13
  - Account of experiments 14
  - Manner of wrapping 15
  - Grafts left unwrapped 16
  - Results of wrapping 16
    - Effect upon the union 16
    - Effect on crown-gall formation 18
  - Recommendations 18
  - Suggestion to nurserymen 19
  - Summary 20
- Garlicky wheat 21
  - Introduction 21
  - Wheat containing garlic 21
  - Experiments in separating garlic from wheat 22
    - Lot A 23
    - Lot B 24
    - Lot C 25

Page

BULLETIN No. 100.—MISCELLANEOUS PAPERS—Continued.
    Garlicky wheat—Continued.
        The total cost of drying and cleaning garlicky wheat 26
            The net cost of removing garlic 28
        The effect of the drying on the milling qualities of the grain 28
        The effect of the drying on the vitality of the wheat 29
        Machinery used for drying and cleaning 30
        Summary 30
    Methods of testing the burning quality of cigar tobacco 31
        Introduction 31
        The smoking test 33
        The effects of the filler, the binder, and the wrapper on the burn of the cigar 35
        Testing the capacity for holding fire and the evenness of the burn 37
        Testing the burn of cigar-filler tobacco 40
    The drug known as pinkroot 41
        Introduction 41
        Trade varieties of pinkroot 41
        Identity of chief substitutes 42
        Minor adulterants 43
        Methods of distinguishing pinkroot from its substitutes 43
    Orchard grass 45
        Introduction 45
        Methods of culture 46
            Seeding 46
            Mixtures with red clover 47
            Mixtures with other grasses 48
            Life of meadows 49
        Uses and value 49
            Hay 49
            Pasture 50
            Seed 50
                Harvesting the seed crop 51
                Thrashing 51
                Handling the aftergrowth 52
                Value of the straw 52
                Weeds in orchard grass seed fields 53
                Other grasses in fields intended for seed 54
        Summary 55
    The effect of copper upon water bacteria 57
        Introduction 57
        Resistance of various bacteria 59
        Effect of carbon dioxid on viability of Bacillus coli and Bacillus typhi 64
        Copper sulphate and filtration 69
    Conditions affecting legume inoculation 73
        Introduction 73
        Use of lime 74
        Effect of soil conditions upon bacteria 76
        Effect of heavy inoculation 79
        Effect of aeration 81
        Associative action of bacteria 82
        Summary 83

Page.

BULLETIN NO. 101.—CONTENTS OF AND INDEX TO BULLETINS OF THE BUREAU OF PLANT INDUSTRY NOS. 1 TO 100, INCLUSIVE.

Introductory statement 7
List, with contents, of Bulletins of the Bureau of Plant Industry Nos. 1 to 100, inclusive 11
Index to Bulletins of the Bureau of Plant Industry Nos. 1 to 100, inclusive 41

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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO.

B. T. GALLOWAY, *Chief of Bureau.*

THE PHILADELPHIA
APR 16 1907
MUSEUMS

SEEDS AND PLANTS IMPORTED

DURING THE PERIOD FROM DECEMBER, 1903, TO DECEMBER, 1905.

INVENTORY No. 11; Nos. 9897 TO 16796.

ISSUED MARCH 15, 1907.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1907.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
OFFICE OF THE CHIEF,
Washington, D. C., August 1, 1906.

SIR: I have the honor to transmit herewith and to recommend for publication as Bulletin No. 97 of the series of this Bureau the accompanying manuscript entitled "Seeds and Plants Imported during the Period from December, 1903, to December, 1905."

This manuscript has been submitted by the Botanist in Charge of Seed and Plant Introduction and Distribution with a view to publication.

Respectfully,

B. T. GALLOWAY,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

THE PHILADELPHIA MUSEUMS
APR 16 1907

B. P. I.—231.

SEEDS AND PLANTS IMPORTED DURING THE PERIOD FROM DECEMBER, 1903, TO DECEMBER, 1905.

INTRODUCTORY STATEMENT.

This is the eleventh inventory of seeds and plants that have been gathered together by this Office, mainly from foreign countries, and represents two years of work.

It is not published to inform experimenters of plants that are on hand for distribution, because in the great majority of cases the plants and seeds listed have been imported for special problems upon which the Department is at work and they have been already assigned to their respective experimenters and are now, many of them, growing in some part of the country.

These inventories are historical records of the introduction of new plants, some of which have already started new industries in this country. In the past historians have as a rule disdained to consider the advent of a new crop as worthy of careful record, notwithstanding the fact that its arrival might exert a remarkable influence upon the development of the country. It is believed that the publication by the Government of such a record will avoid in the future for these new industries the uncertainty which now exists as to the time of arrival in America of some of our most important plant cultures, which were probably first introduced by the Department of Agriculture. To the large number of agricultural experiment station workers and others who are experimenting with the various introductions, these inventories will be almost indispensable.

As remarked in previous inventories no attempt is made to reform the nomenclature of the plants imported, for in many cases the identification of imported seeds and plants is impossible until several years after their introduction. They must first be grown and studied by specialists in the various plant groups, who are sure sooner or later to include them in their monographs, in which places, and not in such an inventory, botanists are accustomed to search for the most recent nomenclature.

This inventory represents not merely the names of and remarks regarding new plant introductions, but embodies often the notes made at the time of collection by agricultural explorers who have been kept at very considerable expense in the field. In the present case it includes in part the collections made by Prof. H. L. Bolley, of North Dakota, who was sent thru the flax-growing region of Europe in search of the best varieties of flax, especially to find one that was more resistant to the flax rust than those we already have. It covers a portion of the seeds and plants collected by Mr. Ernst A. Bessey during his travels thru a part of the Caucasus, the Crimea, and into Russian Turkestan. It includes a list of valuable new seeds which Hon. Robert P. Skinner very kindly secured in Abyssinia for the Department when sent as commissioner to King Menelik in 1904. The valuable collection of 100 European potato varieties, made by Prof. L. R. Jones, of the University of Vermont, is also included. This inventory includes also the results of Mr. Thomas H. Kearney's explorations in southern Tunis, where he was sent by the Office of Seed and Plant Introduction Investigations to study the date varieties of the Tunisian oases. The collection of date offshoots which Mr. Kearney secured is unique in that it was made after a careful examination of the palms while in full bearing. This is the first time that an agricultural explorer has been given the opportunity to spend the fruiting season in foreign date gardens, and Mr. Kearney's descriptions of the varieties collected in Tunis are from actual observation and not from hearsay. Dry land olives, pomegranates, pistaches, spineless opuntias, and drought-resistant fodder crops were also given attention by Mr. Kearney while in this interesting desert region. The collections made by Mr. P. H. Rolfs during his explorations of the vanilla-growing regions of Mexico are chronicled in this inventory, and the vanilla cuttings secured at that time are contributing their share toward the solution of the problem of vanilla culture in Florida.

A. J. PIETERS,
Botanist in Charge.

OFFICE OF SEED AND PLANT
INTRODUCTION AND DISTRIBUTION,
Washington, D. C., August 1, 1906.

INVENTORY.

9897 to 10260.

From Russia. Received thru Prof. H. L. Bolley, November 24, 1903.

A miscellaneous assortment of seeds collected by Professor Bolley during the season of 1903, as follows:

9897 to 10167.	Linum usitatissimum.	**Flax.**
10168 to 10182.	Secale cereale.	**Rye.**
10183 to 10193.	Avena sativa.	**Oat.**
10194 to 10218.	Triticum vulgare.	**Wheat.**
10219 to 10222.	Hordeum vulgare.	**Barley.**
10223 to 10225.	Helianthus annuus.	**Sunflower.**
10226.	Bromus inermis.	**Smooth brome-grass.**
10227 to 10231.		**Wild grasses.**
10232 to 10235.	Medicago sativa.	**Alfalfa.**
10236 and 10237.	Ervum lens.	**Lentil.**
10238 to 10240.	Pisum sativum.	**Pea.**
10241 and 10242.	Cannabis sativa.	**Hemp.**
10243 and 10244.	Brassica napus.	**Rape.**
10245 to 10247.	Brassica sp.	**Mustard.**
10248.	Cucumis melo.	**Muskmelon.**
10249.	Citrullus vulgaris.	**Watermelon.**
10250.	Ribes grossularia (?).	**Gooseberry.**
10251.	Gleditschia sp.	**Honey locust.**
10252.	Coronilla varia.	**Crown vetch.**
10253.	Lotus corniculatus.	**Bird's-foot trefoil.**
10254.	Trifolium sp.	**Wild clover.**
10255.	Lathyrus sylvestris.	**Flat pea.**
10256 and 10257.	Vicia sp.	**Wild vetch.**
10258.	Vicia sp.	**Wild yellow vetch.**
10259.	Papaver sp.	**Poppy.**
10260.	Prunus sp.	**Cherry.**

10261 to 10263.

From Khojend, Russian Central Asia. Presented by Mr. E. Valneff to Mr. E. A. Bessey. Received December 18, 1903.

10261. Pyrus malus. **Apple.**

Seed from wild trees in the mountains.

10261 to 10263—Continued.

10262. Prunus divaricata. **Plum.**

Black variety. Seed from wild trees in the mountains.

10263. Prunus divaricata. **Plum.**

Yellow variety. Seed from wild trees in the mountains.

10264. Quercus suber. **Cork oak.**

From Mustapha, Algeria. Received thru Dr. L. Trabut, December 18, 1903.

10265 and 10266. Pistacia mutica. **Turpentine tree.**

From Smyrna, Turkey in Asia. Received thru Mr. B. J. Agadjanian, December 15, 1903.

10265. Very dark brown. **10266.** Very bright green.

10267. Pistacia atlantica. **Bitoom.**

From Duperre, Algeria. Received thru Mr. Franck Joly, December, 18, 1903.

10268. Pistacia terebinthus. **Terebinth.**

From Marseille, France. Received thru Mr. Claude Montel, nurseryman, by Mr. W. T. Swingle, August, 1903.

10269. Avena sativa. **Oat.**

From Mustapha, Algeria. Received thru Dr. L. Trabut, government botanist, by Mr. T. H. Kearney, December 18, 1903.

10270 to 10274.

From Åbo, Finland. Presented by Mr. Alarik Rosenberg, seedsman. Received September 25, 1903.

Seed from crop of 1903, grown on Hovirinha farm in St. Kerins county, state of Åbo and Björneborg, Finland.

10270. Hordeum vulgare. **Barley.**

10271. Avena sativa. **Oat.**

10272. Triticum vulgare. **Wheat.**

10273. Secale cereale. **Rye.**

10274. Pisum sativum. **Pea.**

10275 to 10283.

From Stockholm, Sweden. Secured by Mr. J. E. W. Tracy, thru the American consul at Stockholm, from the Governor of Luleå, Sweden. Received September 25, 1903.

10275. Hordeum vulgare. **Barley.**

10276. Hordeum vulgare. **Barley.**

10277. Triticum vulgare. **Wheat.**

10278. Avena sativa. **Oat.**

White.

10279. Avena sativa. **Oat.**

Black.

10280. Secale cereale. **Rye.**

10281. Cannabis sativa. **Hemp.**

10282. Phleum pratense. **Timothy.**

10283. Vicia cracca.

10284. PHASEOLUS RADIATUS. **Mung bean.**

From Beaukiss, Tex. Received thru Mr. John B. Lesheen, December 11, 1903.

Grown in 1903 from S. P. I. No. 6430.

10285 to 10288.

From Paris, France. Received thru Mr. W. T. Swingle from the Jardin des Plantes, December 21, 1903.

Cuttings of four species of pistache, as follows:

10285. PISTACIA CHINENSIS.

10286. PISTACIA TEREBINTHUS. **Terebinth.**

10287. PISTACIA MUTICA. **Turpentine tree.**

10288. PISTACIA ATLANTICA. **Bitoom.**

10289 to 10308. VITIS VINIFERA. **Grape.**

From Erivan, Caucasus, Russia. Received thru Mr. E. A. Bessey, December 21, 1903.

10289. *Black Yezandari.*
10290. *Huseïni.*
10291. *White Saabi.*
10292. *Mskhali.*
10293. *White Kishmish.*
10294. *Khalili* (probably *Yellow Khalili*).
10295. *Shirshira.*
10296. *Kulami.*
10297. *Ambari.*
10298. *Gulyabi.*
10299. *Kyechmamasi.*
10300. *Shirazu.*
10301. *Yellow Yezandari.*
10302. *Goi-chezandaei.*
10303. *Sem - raz' - daet* (sevenfold).
10304. *Urza.*
10305. *Saäbi* (rose-colored).
10306. *Khatchabas.*
10307. *Ak uzyum* (white grape).
10308. *Red Kishmish.*

10309 and 10310.

From Tanegashima, Japan. Presented by Mr. R. Chester to Mr. R. B. Handy. Received December 12, 1903.

Native Japanese seeds as follows:

10309. **"Raishi."**

A kind of gourd. "Sow when other squashes are sown, covering the seed, lightly with straw. Train on sticks."

10310. CUCURBITA sp. **"Kaboucha."**

A kind of gourd. Culture same as No. 10309.

10311 to 10314.

From Honolulu, Hawaii. Received thru Mr. J. G. Smith, Special Agent in Charge of the Hawaii Experiment Station, December 26, 1903.

Specimens of native yams, as follows:

10311. DIOSCOREA DIVARICATA (?). **"Hoi."**

Tubers 4 inches in diameter.

10312. DIOSCOREA DIVARICATA (?). **"Hoi."**

Axillary tubers.

10313. TACCA PINNATIFIDA. **"Pia."**

Tuber 5 inches in diameter.

10314. SMILAX SANDWICENSIS. **"Uhi."**

10315. LINUM USITATISSIMUM. **Flax.**

From Russia. Collected by Prof. H. L. Bolley in the season of 1903. Received December 21, 1903.

(Ramm, No. 2760.) Sample of *Dalgonetz* flax, crop of 1902, from Kharkof government.

10316. LINUM USITATISSIMUM. **Flax.**

From Russia. Collected by Prof. H. L. Bolley in the season of 1903. Received December 21, 1903.

Diriny Gorky flax (Sakowickz No. 1). (See No. 9989.)

10317. LINUM USITATISSIMUM. **Flax.**

From Russia. Collected by Prof. H. L. Bolley in the season of 1903. Received December 21, 1903.

Diriny Gorky (Sakowickz No. 2). Seed said to be the same pedigree as "No. 1," S. P. I. No. 10316.

10318. TRITICUM VULGARE. **Wheat.**

From Kharkof, Russia. Collected by Prof. H. L. Bolley in the season of 1903. Received December 21, 1903.

10319. TRITICUM VULGARE. **Wheat.**

From Kharkof, Russia. Collected by Prof. H. L. Bolley in the season of 1903. Received December 21, 1903.

10320. SECALE CEREALE. **Rye.**

From Russia. Collected by Prof. H. L. Bolley in the season of 1903. Received December 21, 1903.

10321. AVENA SATIVA. **Oat.**

From Russia. Collected by Prof. H. L. Bolley in the season of 1903. Received December 21, 1903.

10322. PISTACIA TEREBINTHUS. **Terebinth.**

From Paris, France. Received thru Vilmorin-Andrieux & Co., December 30, 1903.

10323. PISTACIA VERA. **Pistache.**

From Catania, Sicily. Received thru Mr. Robert W. Heingartner, December 30, 1903.

10324. SOLANUM COMMERSONI. **Aquatic potato.**

From Marseille, France. Received thru Dr. E. Heckel, January 2, 1904.

"Tubers of the so-called 'aquatic potato' of Uruguay. This species from Uruguay is being experimented with by Doctor Heckel, of Marseille, who is breeding it with the ordinary potato and finds that it gives successive crops on the same soil without the necessity of replanting. It also gives abundant foliage, which he thinks may be used for green forage. He further points out that the bitter flavor of the skin will protect the potato against the depredations of subterranean enemies. Its keeping qualities during the winter are good. Very little rot appears, and rats are not fond of it. The special point, however, to be emphasized in connection with this new species is that the diseases of the potato do not attack it. One difficulty in its culture consists in the necessity of working over carefully the soil to an unusual depth, because the tubers are deeply buried in the soil. It flowers abundantly, beginning in June and ending in September, the flowers having a perfume similar to that of jasmine. Their odor on a hot day is perceptible for several meters. Planting takes place in southern France by means of whole or cut tubers in April and the harvest is in October. Doctor Heckel's experiments are reported upon in the following publications: Sur le Solanum commersoni Dunal, ou pomme de terre aquatique de l'Uruguay, in the Revue Horticole, No. 581, December, 1902, p. 200; Contribution à l'Étude Botanique de quelques Solanum Tubérifères, par M. Édouard Heckel." (*Fairchild.*)

10325. HEDYSARUM CORONARIUM. **Sulla.**

From Malta. Received thru Dr. G. Borg, December 27, 1903.

"Dried roots of sulla covered with the root tubercles caused by *Bacillus radicicola.* These are imported in order to enable Doctor Moore to make cultures of the germ and ultimately to enable rational experiments to be carried out with this important forage plant, especially adapted to the poor soils, rich in lime, in our Southern States." (*Fairchild.*)

10326. PANAX GINSENG. **Ginseng.**

From Korea. Received thru the North Pacific Trading Company, 56 Fifth avenue, Chicago, Ill., January 7, 1904.

Seed guaranteed by the North Pacific Trading Company to be genuine imported seed.

10327. ANDROPOGON SORGHUM. **Sorghum.**

From Durban, Natal. Received thru Messrs. Lathrop and Fairchild from Mr. Reuben W. Beningfield, January 14, 1904.

Native name *Mapela.* "Seed of a variety of sorghum from the east coast of Africa. This variety is that upon which the natives live, and according to Mr. Claude Fuller, entomologist of the Natal agricultural department, it has proved more resistant to a species of aphis which attacks the sorghum in that region than others which were growing side by side with it. This may prove of value in the sorghum regions of this country." (*Fairchild.*)

10328. PISTACIA ATLANTICA. **Bitoom.**

From Orléansville, Algeria. Received thru Yahia ben Kassem, January 14, 1904. Collected in the Sahara.

10329. PHASEOLUS RADIATUS. **Mung bean.**

From Cairo, Ga. Received thru Mr. J. B. Wight, January 14, 1904.

Grown from S. P. I. No. 6430.

10330. AVENA SATIVA. **Oat.**

From Agricultural College, N. Dak. Received November 30, 1903.

Swedish Select. Grown by the North Dakota Agricultural Experiment Station from S. P. I. No. 9422.

10331 to 10339.

From Khojend, Russian Central Asia. Presented to Mr. E. A. Bessey by Mr. E. Valneff. Received January 21, 1904.

10331 to 10334. VITIS VINIFERA. **Grape.**

Cuttings of the best varieties of grapes grown in Russian Central Asia, as follows:

10331. *Tcharas,* or *Charas.*

10332. *White Kishmish.*

10333. *Black Kishmish.*

10334. *Maizi.*

10331 to 10339—Continued.

10335 to 10337. AMYGDALUS PERSICA. **Peach.**

Cuttings as follows:

10335. *Rugani gau* (or *gow*).

10336. *Shaftali-inzhir.*

10337. *Shaftali*, white.

10338. AMYGDALUS COMMUNIS. **Almond.**

Cuttings.

10339. JUGLANS REGIA. **Persian walnut.**

Nuts from trees growing at a considerable altitude, and should, therefore, be rather late in blooming.

10340 to 10342. VITIS VINIFERA. **Grape.**

From Nikita, near Yalta, Crimea. Presented to Mr. E. A. Bessey by Mr. Theophil Kalaida, head gardener of the Imperial Gardens at Nikita. Received January 29, 1904.

Grape cuttings as follows:

10340. *Shabash.*

Most widely cultivated of the native sorts in Crimea, nine-tenths of the exported Crimean grapes being of this sort (in 1891). A greenish grape, forming medium-sized to large, firm bunches of large roundish berries. Table sort. (Marked *Madame* on label attached to cuttings.)

10341. *Tchauch.*

Greenish, large berries, often almost like plums. Bunches loose. Rather capricious, being easily affected by rainy or windy weather. Not much exported. Dessert sort.

10342. *Asma.*

Blue black, large, elongated berries in large bunches. Table sort. Not so good as the preceding, but prized for the table because of the contrast between its black bunches and the greenish ones of the other sorts.

10343 and 10344. CORYLUS AVELLANA. **Filbert.**

From Nikita, near Yalta, Crimea. Presented to Mr. E. A. Bessey by Mr. Theophil Kalaida, head gardener of the Imperial Gardens at Nikita. Received January 29, 1904.

10343. *Badem.*

Native near Yalta. Elongated, large nuts.

10344. *Trebizond.*

Native near Trebizond, Asiatic Turkey. Nuts large and round; much grown around Yalta.

10345 to 10348. PYRUS MALUS. **Apple.**

From Nikita, near Yalta, Crimea. Presented to Mr. E. A. Bessey by Mr. Theophil Kalaida, head gardener of the Imperial Gardens at Nikita. Received January 29, 1904.

10345. *Sabla Sinap.*

Distinguished for its beautiful appearance.

10346. *Kandil Sinap.*

Widely grown in the Crimea. Fruit longer than No. 10348. For description of both, see *Revue Horticole*, No. 17, 1890, p. 398.

10347. *Konstantinopel.*

10348. *Sari Sinap.*

The most widely grown and best of the Crimean apples. Very late keeper.

10349 to 10351. SORBUS DOMESTICA. **Service tree.**

From Nikita, near Yalta, Crimea. Presented to Mr. E. A. Bessey by Mr. Theophil Kalaida, head gardener of the Imperial Gardens at Nikita. Received January 29, 1904.

10349. *Grossfrüchtige.*

A sort with pear-shaped fruits, 1¼ to 1½ inches by 1 to 1¼ inches.

10350. *Gewöhnliche.*

A sort with apple-shaped fruits, about 1 inch in diameter. Both this and No. 10349 ripen rather late.

10351.

Seedlings about 18 inches high.

10352. TRIFOLIUM JOHNSTONI (?). **Uganda clover.**

From Uganda, East Africa. Received thru Mr. D. G. Fairchild from Mr. R. N. Lyne, Director of Agriculture, Zanzibar, East Africa, January 30, 1904.

"The identification of this species has not been definitely made, but according to a letter of December 29 from Mr. Lyne this is the Uganda clover, which may be of value for breeding experiments in this country. The high plateau of Uganda, upon which this clover grows, altho in the Tropics, has a comparatively mild climate. It is, of course, quite frostless. Mr. Lyne reports nothing further regarding the usefulness of this species, but remarks that Mr. Ainsworth, who secured the seed for him, had great difficulty in collecting it." (*Fairchild.*)

10353. PHASEOLUS VULGARIS. **Bean.**

From Garrettsville, Ohio. Received thru Mr. George J. Streator, February 1, 1904. Grown from S. P. I. No. 3382.

Mr. Streator reports that these beans are far superior to the ordinary white bean, for the reason that they do not spot so badly in wet weather.

10354 to 10363.

From Newton-le-Willows, Lancashire, England. Presented by T. and J. Garton for testing at the experiment stations. Received February 1, 1904.

10354. AVENA SATIVA. **Oat.**

Yellow. (No. 1.)

10355. AVENA SATIVA. **Oat.**

Gray. (No. 2.)

10356. AVENA SATIVA. **Oat.**

Black. (No. 3.)

10357. AVENA SATIVA. **Oat.**

Black. (No. 4.)

10358. AVENA SATIVA. **Oat.**

White. (No. 5.)

10359. AVENA SATIVA. **Oat.**

White. (No. 6.)

10360. HORDEUM HEXASTICHUM. **Six-row barley.**

(No. 7.)

10361. HORDEUM HEXASTICHUM. **Six-row barley.**

(No. 8.)

10362. HORDEUM DISTICHUM. **Two-row barley.**

(No. 9.)

10363. HORDEUM DISTICHUM. **Two-row barley.**

(No. 10.)

10364. TRITICUM DURUM. **Wheat.**

From Idalia, Colo. Received thru Mr. J. A. Riedesel, February 4, 1904. Grown from S. P. I. No. 9478.

Kubanka macaroni wheat.

10365. CITRUS LIMETTA. **Lime.**

From Seharunpur, India. Presented by Mr. W. Gollan, superintendent of the Government Botanical Gardens, at the request of Rev. N. L. Rockey. Received February 5, 1904, thru Mr. G. N. Collins.

"Fruits at Seharunpur and also at Mussoorie at an altitude of 5,800 feet. A good lime and the hardiest of the Indian sorts." (*Gollan.*)

10366. SECALE CEREALE. **Rye.**

From San Giovanni a Teduccio (near Naples), Italy. Received thru Dammann & Co., February 6, 1904.

Abruzzes.

10367. SECALE CEREALE. **Rye.**

From North Water Gap, Pa. Received thru Mr. M. Luther Michael, February 8, 1904.

Winter Ivanof. Grown in 1903 from S. P. I. No. 1342.

10368 to 10370. PUNICA GRANATUM. **Pomegranate.**

From Chios, Turkey in Asia. Presented by Mr. N. J. Pantelides. Received February 9, 1904.

10371. ELAEAGNUS ANGUSTIFOLIA. **Oleaster.**

From Tiflis, Caucasus. Presented to Mr. E. A. Bessey by Mr. A. Rolloff, director of the Tiflis Botanical Garden. Received February 10, 1904.

Unab-pschat ("date fruit"), a sort with large fruits.

10372. ELAEAGNUS ANGUSTIFOLIA. **Oleaster.**

From Tiflis, Caucasus. Presented to Mr. E. A. Bessey by Mr. A. Rolloff, director of the Tiflis Botanical Garden. Received February 10, 1904.

Matna-pschat ("finger fruit"), a large-fruited sort.

10373 and 10374. TRIFOLIUM ALEXANDRINUM. **Berseem.**

From Cairo, Egypt. Received thru Mr. George P. Foaden, secretary of the Khedivial Agricultural Society, February 10, 1904.

10373. *Muscowi*, or *Misowi*. **10374.** *Saida*, or *Saidi*.

10375. LATHYRUS SATIVUS. **Bitter vetch.**

From Cairo, Egypt. Presented by Mr. George P. Foaden, secretary of the Khedivial Agricultural Society. Received February 10, 1904.

Known in Egypt as *Gilban*.

10376 and 10377. PISTACIA spp.

From Aintab, Turkey in Asia. Received thru Rev. A. Fuller, February 12, 1904.

10376. PISTACIA VERA. **Pistache.**

Mixed varieties of the true pistache.

10377. PISTACIA MUTICA. **Turpentine tree.**

"Obtained from the eastern slope of the Amanus Mountains 60 miles west of Aintab, and 'can be relied on as good.' Trees there are largest and best in the country and climate as dry as could be desired, not being subject to the moisture which affects the western slope of the mountains, because of the nearness to the sea. This variety will take the grafts (buds) of *P. vera.*" (*Fuller.*)

10378. LINUM USITATISSIMUM. **Flax.**

From Salem, Oreg. Received thru Mr. Eugene Bosse, January 28, 1904.

Grown in 1903 from S. P. I. No. 9457.

10379 to 10381. LINUM USITATISSIMUM. **Flax.**

From Vologda, Russia. Procured by Prof. H. L. Bolley from Mr. Pierotraschko, government agronomist. Received January 25, 1904.

From the northern limit for the maturing of flax seed, where the very finest type of Russian fiber is produced.

10382 to 10391. TRITICUM spp. **Wheat.**

From Cairo, Egypt. Presented by Mr. George P. Foaden, secretary of the Khedivial Agricultural Society. Received February 19, 1904.

10392 to 10396. CAPSICUM ANNUUM. **Pepper.**

From Santa Clara, Cal. Received thru C. C. Morse & Co., January, 1904.

Seed grown from stock furnished by the Department, as follows:

10392. **Paprika pepper.**

Grown from S. P. I. No. 9475.

10393. **Red pepper.**

Grown from S. P. I. No. 3733.

10394. **Red pepper.**

Grown from S. P. I. No. 7654.

10395. **Red pepper.**

Grown from S. P. I. No. 3977.

10396. **Sweet pepper.**

Grown from S. P. I. No. 3905.

10397. RAPHANUS SATIVUS. **Radish.**

From Santa Clara, Cal. Received thru C. C. Morse & Co., January, 1904.

Erfurt Crimson Giant. Grown from S. P. I. No. 9487.

10398. LOTUS TETRAGONOLOBUS. **Winged pea.**

From Santa Clara, Cal. Received thru C. C. Morse & Co., January, 1904.

Grown from S. P. I. No. 7700.

10399. RAPHANUS SATIVUS. **Radish.**

From Santa Clara, Cal. Received thru C. C. Morse & Co., January, 1904.

Everlasting. Grown from S. P. I. No. 4966.

10400 and 10401. ZEA MAYS. **Sugar corn.**

From Auburn, N. Y. Received thru Mr. G. W. Boynton, February 25, 1904.

Malakhof. Two selections of *Malakhof* corn grown from S. P. I. No. 2799.

10400. First early.

10401. Better quality, but second early.

10402. HORDEUM DISTICHUM NUTANS. **Two-row barley.**

From Kwassitz, Austria. Received thru Aktien-Zuckerfabrik, March 2, 1904.

Original *Hanna* pedigreed brewing barley.

10403 to 10404. GOSSYPIUM ARBOREUM (?). **Tree cotton.**

From Guadalajara, Mexico. Secured by Mr. Edward B. Light, United States consular agent for Señor Hilario Cuevas, of San Luis Soyatlan, Jalisco, Mexico. Received February 10, 1904.

10403. (Light's No. 1.)

"The common variety which grows wild in many parts of the state. It is claimed that the tree resists the effects of the drought when other trees perish. There are no known cultivated cotton trees, but there are native trees which have produced a harvest of 50 pounds of cotton. Neither the light frosts we have, nor the boll weevil, nor any other insects injuriously affect the trees. This is claimed by people who have known the tree for fifty years." (*Light.*)

10404. (Light's No. 2.)

"The finest quality of cotton, and yields more prolifically. It seems that a quarter of a century or more ago the natives used this cotton for making cloth, but none has been made of late years and the trees have never been cultivated by the present generation with that end in view. This tree is readily grown and is very hardy. The tree usually begins to bear when it is from 4 to 5 years old." (*Light.*)

10405. MUSA TEXTILIS. **Manila hemp.**

From Manila, P. I. Presented by Mr. H. T. Edwards, of the Bureau of Agriculture, to Mr. L. H. Dewey. Received February 29, 1904.

Seed collected in Tayanas Province.

10406. VICIA FABA. **Broad bean.**

From London, England. Received thru James Veitch & Sons (Limited), 544 King's road, Chelsea, March 1, 1904.

Veitch's Improved Longpod. This variety should be sown in pots or boxes in a cold frame in January and transplanted early in March, lifting with a good ball and molding up the plants. This is better for early supplies than sowing in the open in autumn. For succession the seed should be sown every three weeks from February 1 until June, on a north border in heavy loam in rows 3 feet apart. To get early pods, topping should take place when a good set of blooms is secured.

10407. PHASEOLUS RADIATUS. **Mung bean.**

From Whittier, Cal. Received thru Mr. C. W. Leffingwell, jr., March 5, 1904. Grown from S. P. I. No. 6430.

10408. (Undetermined.)

From Cochin China. Presented by Mr. J. B. de Taillac, Astoria, Long Island City, N. Y., February 25, 1904.

According to Mr. de Taillac's letter this plant exhales an essence which is so disagreeable to mosquitoes that when placed in windows the insects do not enter the room. This evidence of the efficaciousness of the plant Mr. de Taillac asserts on the information of a friend in Cochin China, where the plant is indigenous.

Mr. de Taillac further remarks that this is also a fodder plant of some value, altho it gives to the milk a slightly disagreeable taste, which can be remedied, however, by the addition to the ration of such a fodder as beets. (See letter of February 3, 1904.)

10409. SWIETENIA MAHAGONI. **Mahogany.**

From Santa Clara, Cuba. Presented by Julio S. Montero & Brothers, March 4, 1904.

Caoba. Seeds of mahogany from the plantation of the father of Montero & Brothers, situated in the province of Santa Clara.

10410. ALEURITES CORDATA. **Wood-oil tree.**

From Hankow, China. Presented by Hon. L. S. Wilcox, consul-general. Received March 3, 1904.

Seed of the wood-oil tree from the province of Hunan, China, fall crop of 1903. According to Consul-General Wilcox's letter of January 12, 1904, "this tree grows wild in the mountains of Szechuan and is also cultivated in the lowlands. The trees, reaching 15 to 20 feet in height, are grown from seed and produce nuts in five or six years. The oil is prest from these seeds, and when they are roasted, before being prest, the oil is more easily extracted. It is better and more is obtained by the latter process. There are several varieties of oil. The yellow or straw-colored one is most exported. The price in this market at present is $5 gold a picul (33⅓ pounds). One variety is black and quite thick and is used entirely by the Chinese. It costs $9 to $10 a picul.

"The name of the oil differs in various localities, as *tung-yu* and *pai-yr*. The value of this oil is due to its astringent and drying qualities. It is used in paints, fine varnishes, and in the manufacture of fine soaps. During the past two years orders from the United States have been constantly increasing, from both the Atlantic and the Pacific coasts. The export is in its infancy but rapidly increasing. The past year 54,475,900 pounds of wood oil were exported from Hankow. This export is annually increasing, the larger portion going to Europe. Seeds can be obtained about the first of the year from orders filled in Hunan and Szechuan. Some have already been sent to the San Joaquin Valley, in California, to a private individual, where they are growing finely, and have led to a request for about 5,000 more seeds from the same party." See also No. 13104.

10411 to 10419. VICIA FABA. Broad bean.

From London, England. Received thru William Bull & Sons, Chelsea, S. W., March 3, 1904.

10411. *Bull's Mammoth.*
10412. *Beck's Dwarf Green Gem.*
10413. *Early Longpod.*
10414. *Green Longpod Nonpareil.*
10514. *Monarch Longpod.*
10416. *Seville Longpod.*
10417. *Windsor Improved.*
10418. *Windsor Green Harlington.*
10419. *Johnson's Wonderful Longpod.*

"Broad beans are gross feeders and require a good rich soil and a liberal supply of manure for successful growth. For successional and main crops sow in February, March, and April. The later kinds should be planted in drills 3 inches deep, 4 to 6 inches apart in the rows, the rows to be 2 feet apart. A deep, strong, tenacious soil, liberally manured, is most suitable. Gather for the table when the beans are no larger than full-grown peas, as they become almost uneatable if left to mature, the tegument then being objectionably tough and leathery and the flavor strong. Pick evenly, not young and old together. In England broad beans are subject to black fly, which, if allowed to make headway, will ruin the crop.

"In England the broad bean is one of the best-paying vegetables, and altho it has been successfully grown in America its good qualities have not yet come to be appreciated here. It is worthy of serious consideration." (*Fairchild.*)

10420 to 10435. VICIA FABA. Broad bean.

From London, England. Received thru James Carter & Co., March 3, 1904.

10420. *Carter's New Market Garden Windsor.*
10421. *Carter's Improved Windsor.*
10422. *Carter's Seville Giant Longpod.*
10423. *Carter's Mammoth Longpod.*
10424. *Early Mazagan.*
10425. *Early Longpod.*
10426. *Royal Dwarf Fan.*
10427. *Aquadulce.*
10428. *Minster Giant Longpod.*
10429. *Carter's Harlington Green Windsor.*
10430. *Green Windsor.*
10431. *Beck's Dwarf Green Gem.*
10432. *Green Longpod.*
10433. *Carter's Masterpiece Green Longpod.*
10434. *Carter's Leviathan.*
10435. *Carter's Green Leviathan.*

Plant from November to January for earliest, and from February to May for main crop.

10436 and 10437. VICIA FABA. **Broad bean.**

From Boston, England. Received thru W. W. Johnson & Son (Limited), March 3, 1904.

10436. *Johnson's Monster Windsor.*

10437. *Johnson's Mammoth Green Longpod.*

In England these beans are frequently sown in November, being perfectly hardy there. It is customary to plant in double rows, viz, 9 inches apart; that is to say, the two rows in a triangular manner. If when full grown in July they are attacked by black fly, cut off the tops of the plants.

10438 to 10448. VICIA FABA. **Broad bean.**

From Reading, England. Received from Sutton & Sons, March 3, 1904.

10438. *Sutton's Improved Windsor.*

10439. *Sutton's Green Windsor.*

10440. *Beck's Dwarf Green Gem.*

10441. *Green Longpod.*

10442. *Sutton's Giant Windsor.*

Culture for 10438 to 10442.—Sow in February, March, April, and May. Double rows are usual, allowing 9 inches between the two lines forming the row, and from 2 to 3 feet between the rows. The best soil for beans is a deep, strong loam, with plenty of manure.

10443. *Sutton's Green Giant.*

10444. *Sutton's Exhibition Longpod.*

10445. *Sutton's Mammoth Longpod.*

10446. *Improved Minster Longpod.*

10447. *Royal Dwarf Cluster.*

10448. *Early Mazagan.*

Culture for 10443 to 10448.—A sowing may be made in November on light, dry soil, but not until January, February, or March on other soils. Double rows are usual, allowing 9 inches between the two lines for all except Nos. 10447 and 10448, for which allow only 6 inches. The double rows in all cases are from 2 to 3 feet apart. The best soil for beans when sown in the spring is a deep loam, which should be well manured.

10449. ILEX CRENATA. **Holly.**

From Yokohama, Japan. Received thru the Yokohama Nursery Company, January 23, 1904.

"Seed of a hardy evergreen, highly esteemed as a good hedge plant for cold climates." (*H. Suzuki.*)

10450. VOANDZEIA SUBTERRANEA. **Woandzu, or African goober.**

From Camden, Ala. Presented by Dr. L. E. Starr. Received February 17, 1904.

Grown from S. P. I. No. 8915, originally from German East Africa.

10451 to 10453. NICOTIANA TABACUM. **Tobacco.**

From Cuba. Received thru Mr. A. D. Shamel, of this Department, March 10, 1904.

10451.

From plantation of Señor Govino Menéndez, near San Juan y Martinez, in the Vuelta Abajo district. (Shamel's No. 1.)

10452. *Cuban.*

From plantation of Señor Galixto López, near San Luis. (Shamel's No. 2.)

10453. *Cuban.*

From plantation of Señor Justinio Sanchez, in Vuelta Abajo district, near Pinar del Rio. (Shamel's No. 3.)

10454. TRITICUM DURUM. **Macaroni wheat.**

From Blackfoot, Idaho. Received thru Prof. H. T. French, director of the Idaho Agricultural Experiment Station, March 9, 1904.

Kubanka macaroni wheat grown from S. P. I. No. 9478.

10455. AVENA SATIVA. **Oat.**

From Blackfoot, Idaho. Received thru Prof. H. T. French, director of the Idaho Agricultural Experiment Station, March 9, 1904.

Swedish Select oat grown from S. P. I. No. 9422.

10456. PHLEUM PRATENSE. **Timothy.**

From Copenhagen, Denmark. Presented by the Botanic Gardens of Copenhagen, thru Prof. Dr. Warming. Received March 8, 1904.

For breeding purposes.

10457. AMYGDALUS PERSICA. **Peach.**

From Bassorah, Arabia. Presented by Haji Abdulla el Nejem, of Bassorah. Received March 8, 1904.

Seeds of various varieties of peaches which are grown in the region of Abdul Khasseb, the great date-growing center of Arabia. These peaches are subjected to the extreme hot weather of this portion of Arabia and are likely to be of interest for breeding purposes in California and Arizona.

10458 to 10461. PHLEUM PRATENSE. **Timothy.**

From Austria-Hungary. Presented by Prof. Emanuel Gross, of the Agricultural Academy, Tetschen-Liebwerd. Received March 9, 1904.

10462. COCHLEARIA ARMORACIA. **Horse-radish.**

From Grand Island, Nebr. Received thru Mr. E. Corbin, March 14, 1904.

Malin. Grown from S. P. I. No. 5761.

10463. CALOPHYLLUM INOPHYLLUM.

From Honolulu, Hawaii. Received thru Mr. J. G. Smith, in charge of the Agricultural Experiment Station, March 12, 1904.

Seed of this tropical tree, related to the mangosteen, for Mr. Oliver's experiments in grafting.

10464. PSIDIUM sp. **Guayabillo.**

From Iguala, Guerrero, Mexico. Presented by Mr. Federico Chisolm, Arcelia. Received January 11, 1904.

10465 to 10472.

From Arcelia, Guerrero, Mexico. Presented by Mr. Federico Chisolm. Received March 12, 1904.

Native Mexican bulbs and seeds, for the most part unidentified.

10473. SOLANUM JAMESII. **Potato.**

From Moab, Utah. Received thru Mr. E. Corbin, of Grand Island, Nebr., March 14, 1904.

Wild or *Cave Dwellers'* potatoes. "I obtained these potatoes last October, when on a visit to southeastern Utah, at Moab, a town about 40 miles south of the Denver and Rio Grande Railway, leaving the railway at Thompson Springs. It is a small town near the mouth of the Grand River where it joins the Green River. Some, found where the ground was soft, were larger than others. It will be seen that there are two kinds. They have run all over the ground where it is not cultivated. They live in the ground frozen hard all winter. They have a top and leaf resembling tomato." (*Corbin.*)

10474. TRITICUM MONOCOCCUM. **Einkorn.**

From Erfurt, Germany. Received thru Haage & Schmidt, March 14, 1904.

10475 to 10521.

From Sydney, New South Wales, Australia. Presented by Mr. J. H. Maiden, superintendent of the Sydney Botanical Gardens. Received March 1, 1904.

A collection of small packets of seed of native plants, as follows:

10475. ACACIA ANEURA.

"Mulga" or "Yarren." A tall shrubby plant or small tree, never attaining a much greater height than 20 feet. Affords an unfailing supply of good forage during long and severe droughts. Drought-enduring qualities are remarkable. Wood is excessively hard and valuable for timber. Considered worthy of cultivation. Western Australia thru mainland colonies to Queensland. Peculiar to the arid western plains beyond the Darling River. (Reference: *Forage Plants of Australia*, p. 33.)

10476. ACACIA MONTANA.

A tall shrub, widely distributed in mountain and forest regions, rocky hills, etc., in the southwestern part of New South Wales.

10477. ACACIA NERIIFOLIA.

A tall shrub. New South Wales, dividing range to table-lands from Clyde River to Queensland; open forests on Balonne River.

10478. ALCHORNEA ILICIFOLIA.

A tall shrub. New South Wales, brush forests; Queensland.

10479. ALPINIA CAERULEA.

An erect perennial herb, 3 to 5 feet, with a terminal inflorescence. New South Wales; coast district in brush forests from Hunter River to Queensland.

10480. BARRINGTONIA ALBA.

Molucca Islands. "The majestic habit of the tree, the splendor of the foliage, the magnificence of the flowers, and, finally, the singular form of the fruit, will attract the attention of the most indifferent." (Extract from *Flore des Serres*, vol. 7, genus description.)

10481. BLANDFORDIA FLAMMEA.

Tender, bulbous plant with large, showy, red flowers in short racemes. Eastern Australia, in peat bogs and on shady mountain sides.

10482. BLENNODIA LASIOCARPA.

"Hairy podded cress." Annual, 1 to 1½ feet high, covered with pubescence; pod hairy. Peculiar to the Darling River, sandy plains near the Murray River, and generally over the arid plains of Australia. Makes its growth during the hottest part of the year; valuable for forage. (Reference: *Forage Plants of Australia*, p. 4.)

10483. BRUNONIA AUSTRALIS.

Herbaceous plant with capitate blue flowers. New South Wales; in dry pastures, chiefly in the west; also in other colonies.

10484. CASSINIA THEODOREI.

A heath-like shrub; branches and under side of leaves woolly white. New South Wales, head of Gwydir River.

10485. CAPPARIS MITCHELLII.

"Native orange." A small tree. Fruit from 1 to 2 inches in diameter; eaten by natives. Wood hard, whitish, close grained, suitable for carving, engraving, and similar purposes. All colonies except Tasmania and Western Australia.

10475 to 10521—Continued.

10486. CASTANOSPORA ALPHANDI.

Large tree with pinnate leaves; flowers racemose-paniculate.

10487. CELTIS PANICULATA.

Tree 25 to 35 feet high; wood soft, white, pliable; used for hoops for casks. New South Wales, Queensland, and northern Australia; not endemic in Australia.

10488. CHLORIS TRUNCATA.

"Windmill grass," or "star grass." An erect grass, perennial and showy. Valuable as a forage plant; an excellent summer and autumn grass. In all Australian colonies except Tasmania and Western Australia.

10489. COMBRETUM LOEFLINGII.

Climbing or diffuse shrub. Tropical South America.

10490. CRASPEDIA RICHEA.

A rather large perennial. New South Wales, thruout the colony in grass land; also in Victoria, Tasmania, South Australia, and Western Australia.

10491. DIANELLA TASMANICA.

Perennial fibrous-rooted plant with grasslike leaves 2 to 4 feet long; large, loose panicles of blue flowers on delicate pendent pedicels. Succeeds best in open border of a cool greenhouse. Tasmania and Australia; common in rich, moist soil.

10492. DILLWYNIA CINERASCENS.

Pretty yellow-flowered juniper-leaved shrub. New South Wales; also coast district and dividing range from Hunter River to Victoria; Tasmania. Common in grassy places.

10493. DODONAEA TRIQUETRA.

"Hop bush." A shrub. Victoria, New South Wales, Queensland.

10494. DYSOXYLON MUELLERI.

"Pencil cedar" or "turnip wood." Tree with compound leaves; timber of a rich, red color; used for cabinetmaking and window work. Northern New South Wales and Queensland.

10495. ELAEODENDRON CURTIPENDULUM.

Probably a tree or shrub. Norfolk Island.

10496. EREMOPHILA BROWNII.

Very variable shrub, often tall. Victoria, Murray desert; New South Wales, western plains; South Australia.

10497. EREMOPHILA LATIFOLIA.

Small spreading shrub. New South Wales, southern interior; Western and South Australia.

10498. EREMOPHILA MACULATA.

Tall shrub with rigid branches. Western and South Australia; western plains of New South Wales and Queensland; Victoria.

10499. EREMOPHILA MITCHELLI.

Shrub or small tree, on elevated stony lands. New South Wales, western plains in the south.

10500. EREMOPHILA OPPOSITIFOLIA.

"Emu bush." Ornamental shrub or small tree, sometimes attaining a height of 20 feet; more or less hoary; leaves 1 to 2 inches in length; flowers about 1 inch long. Grows in the most arid parts of the continent and is available for forage. "Will grow when not a blade of grass is seen for weeks together." Worthy of cultivation. Plains between Lachlan and Darling rivers in New South Wales; near Murray River in Victoria, and in the interior of South Australia.

10475 to 10521—Continued.

10501. EREMOPHILA BOWMANI.

Erect shrub. Western plains from Byrock to Queensland.

10502. ERIOSTEMON DIFFORMIS.

Small bushy shrub. Interior of New South Wales.

10503. EUCALYPTUS BEHRIANA.

A small shrub or small tree. Near sources of Werribee River, on stony hills; in hill forest region of Wirrabara, near Crystal Brook and Mount. Remarkable on deep, nearly clay soil.

10504. EUCALYPTUS DIVERSICOLOR.

"Karri," "Blue gum." Colossal tree, exceptionally reaching a height of 400 feet. Furnishes good timber for building. Southwestern Australia, in fertile, rather humid, valleys; on small elevations in swamps near rivers beyond the reach of water.

10505. EUCALYPTUS COCCIFERA.

Small tree with leaves under 3 inches long. Tasmania, 3,000 to 4,000 feet elevation. Possibly a subalpine form of *E. amygdalina.*

10506. EUCALYPTUS INCRASSATA.

Shrubby or arborescent, exceptionally rising to 30 feet. From the Murray and Darling rivers thru desert tracts to the Great Bight. Chiefly on sand ridges, but also on Tertiary limestone, extending in some places to the brink of the ocean.

10507. EUCALYPTUS TERETICORNIS.

"Flooded gum tree." Tall tree when well developed, but seldom exceeding 100 feet. Timber is excellent. Never very far removed from littoral regions; occupying generally humid flats or growing around swamps and lakes or along water courses, never on saline ground or salt-water streams.

10508. EUCALYPTUS VIRGATA.

A tall, straight-growing white gum. Valleys of the higher parts of the Blue Mountains or at the foot of cliffs in fairly good soil.

10509. HOVEA HETEROPHYLLA.

A blue-flowered, evergreen shrub, prostrate or decumbent. New South Wales, coast district to table-land in dry, stony localities.

10510. MELALEUCA PUSTULATA.

Small or tall shrub. New South Wales, southern interior; Victoria, Tasmania, South Australia.

10511. MYOPORUM DESERTI.

"Sweet-fruited myoporum." Erect shrub, 3 to 4 feet high, with linear leaves 1 to 2 inches long. Said by some to be poisonous when in fruit; others state that it is a capital forage plant. Found principally in the interior of all the colonies of Australia. (See *Forage Plants of Australia,* p. 40.)

10512. OLEARIA PIMELOIDES.

Bushy shrub. Victoria and western plains of New South Wales.

10513. PODOLEPIS ACUMINATA.

Erect perennial shrub. New South Wales; Victoria, Hardinger range at elevations of 5,000 feet; Tasmania, abundant in many parts of the colony, ascending to 4,000 feet.

10514. PROSTANTHERA STRIATIFOLIA.

Rather small, rigid shrub. New South Wales, barren hills of the interior from Lachlen River to Queensland.

10515. GREVILLEA LINEARIS.

A tall, delicate shrub, with spreading branches and linear leaves. New South Wales, coast district and dividing range from Clyde River to Port Jackson.

10475 to 10521—Continued.

10516. SPOROBOLUS LINDLEYI.

A slender-growing perennial grass. Grows on rich soil and is much relished by all kinds of stock. All Australian colonies except Tasmania.

10517. SCLEROLAENA BICORNIS.

"Cotton bush." Small, stout shrub, densely white, tomentose. New South Wales, western plains.

10518. TRICHINIUM ALOPECUROIDEUM.

Rather slender, perennial herb. New South Wales, western plains; also in other Australian colonies.

10519. TRICHINIUM OBOVATUM.

"Silver bush." An erect undershrub 1½ to 4 feet. Flower spikes globular. Has remarkable drought-enduring qualities; will grow in the driest of soils when once fairly established. Valuable as a forage plant. Arid interior of all Australian colonies.

10520. TRICHINIUM EXALTATUM.

Tender perennial, 2 to 3 feet. Western plains of New South Wales; other Australian colonies.

10521. TRICHINIUM NOBILE.

"Yellow-hairy spikes." Stout perennial herb. Not easily affected by drought; affords a rich, succulent herbage even in very dry weather, of which stock are very fond. Interior of New South Wales and South Australia and Victoria. (Reference: *Forage Plants of Australia*, p. 85.)

10522. GARCINIA MORELLA. **Gamboge.**

From Kingston, Jamaica. Presented by Dr. William Fawcett, director of the Botanical Garden. Received March 17, 1904.

"A moderate-sized tree which produces the true gamboge of commerce, used in Europe and America as a pigment. In the Orient this pigment is used for dyeing silks and other fabrics. The oil in the seeds is used in Mysore as a substitute for lamp oil. These seeds are imported for use as a stock for the mangosteen, upon which the latter was grown successfully many years ago by Mr. Harris, superintendent of Castleton Garden, Jamaica, and also later by Mr. Hart, of Trinidad. Fruit the size of a cherry, subglobose, slightly four-lobed, four-celled, and four-seeded. In Singapore this species grows without any particular attention, it is said, and attains a height of 35 to 50 feet. It is probable that this species has a much more vigorous root system than the mangosteen, and is therefore a promising possibility as a stock for the mangosteen." (*Fairchild.*)

10523. PHASEOLUS ANGULARIS. **Bean.**

From Kingston, R. I. Presented by Mr. G. E. Adams, of the Rhode Island Agricultural Experiment Station. Received March 12, 1904.

A bean secured by Professor Brooks, of the Massachusetts Agricultural Experiment Station, in Japan, under the name of "*White-Podded Adzuki* soy bean."

10524. MISCANTHUS CONDENSATUS (?).

From Yokohama, Japan. Presented by Mr. H. Suzuki, of the Yokohama Nursery Company. Received March 9, 1904.

"This root having been brought from the southeastern part of Japan, where there is no snow in winter, it is doubtful whether it will stand your climate. It will therefore be well to try it in such Southern States as Florida or California. I am sure it will succeed well. In the native region where these plants are growing its leaves remain green all thru the year and cattle are fed upon it. It should be cut while young, before its full growth, as the stem gets too hard if left too long. Young stems can be cut gradually from time to time thruout nearly the whole year, but a few stems on each clump should always be left without cutting, as it sometimes dies out if cut off too severely. I endeavored to get some seed of this plant, but the stems being constantly cut by the villagers make it very difficult to secure them. It seldom flowers. The roots, however, can be secured in any quantity." (*Suzuki.*)

10525. PYRUS MALUS. **Apple.**

From Amassia, Turkey. Presented by Mr. H. Caramanian. Received March 16, 1904.

Misket. A variety of apple from this noted fruit region of Turkey. In letter of April 25, Mr. Caramanian remarks "that the Misket apple is the best variety of apple grown in this country. It has a crimson-red color when fully ripe. Its texture is fine and its flavor deliciously sweet. It has a keen, musky smell peculiar to itself, from which it takes its name, *misk* in Arabic meaning musk. In a room containing only one apple one may discover its presence by its smell. In exceptional cases individual specimens weigh as much as a pound, but are generally smaller. In such a town (Amassia), where a hundredweight of peaches costs from 20 to 25 cents, this apple is sometimes sold as high as 15 cents a pound. First-class apples are exported to Constantinople and the rest are used here."

10526. PRUNUS DOMESTICA. **Plum.**

From Amassia, Turkey. Presented by Mr. H. Caramanian. Received March 16, 1904.

Uryäný. A variety of plum from this noted fruit region of Turkey. In a letter of April 25, Mr. Caramanian says: "The Uryäný plum is one of the choicest varieties of plums that I have ever seen here or in America. It is of a greenish yellow color when fully ripe. It is very fleshy and juicy, with an exceedingly thin skin. It tastes sweet and the stone is not very loose. As the orchardists do not know how to take care of the fruit trees, we find only a few perfect specimens on the trees."

10527. PHASEOLUS RADIATUS. **Mung bean.**

From Patras, Greece. Received thru Mr. Socrates Xanthopoulo, March 17, 1904.

10528 to 10530. ALNUS spp.

From Yokohama, Japan. Presented by Mr. H. Suzuki, of the Yokohama Nursery Company. Received March 9, 1904.

10528. ALNUS JAPONICA (?).

10529. ALNUS FIRMA.

10530. ALNUS INCANA.

"Species of Alnus which are used by the Japanese as shade or shelter trees in the plantations of the Mitsumata paper plants, especially on hillside plantations. From the fact that the different species of Alnus produce root tubercles it is hoped that cultures can be secured of the micro-organisms which form them. It has been suggested by Mr. Swingle that the value of this Alnus as a shelter plant may be due largely to the nitrogen-collecting power of these tubercles. If this proves to be true, the cultivation of these species of Alnus may be of value for certain American cultures and especially in connection with the cultivation of the paper plant." (*Fairchild.*)

10531. BETA CICLA. **Leaf beet.**

From Vomero, near Naples, Italy. Presented by Dr. Carl Sprenger, March 18, 1904.

Seeds for experiments in breeding with the sugar beet, to be carried on by Dr. C. O. Townsend and Mr. E. C. Rittue.

10532. TRIFOLIUM PRATENSE. **Red clover.**

From Riga, Russia. Secured by Mr. E. A. Bessey from Mr. Heinrich Goegginger. Received March 21, 1904.

Orel.—The seed of the promising hairless clover No. 16, to which it is desired to call special attention, was obtained by Mr. Bessey through Mr. Goegginger, of Riga, and was produced on the estate of a German grower near Yeletz, in the eastern part of the Orel government. The grower made a practise of saving his own seed, and hence this strain had been grown on the same estate for a number of years.

According to Mr. Goegginger, the government of Orel furnishes the best red clover seed obtainable in Russia. Its chief crops are winter rye and oats, and it is in rotation with these that the clover is grown. A small quantity of winter wheat is also grown.

This variety is distinguished by the dustlessness of its hay, due to almost complete absence of hairiness from all parts of the plant; by its heavy yields for the first crop; by its leafiness and the persistence of the basal leaves; by the succulence of the stems, which improves greatly the quality of the hay and reduces the waste due to woody, uneatable portions; by greater palatability than hay from domestic seed, and by the fact that it comes to proper maturity for harvesting from ten days to two weeks later than the ordinary American red clover.

Except in certain sections and for certain purposes this variety is not recommended for supplanting domestic red clover, but rather for supplementing the latter. See Bulletin No. 95 of the Bureau of Plant Industry entitled "A New Type of Red Clover." (*Charles J. Brand.*)

10533 and 10534. TRIFOLIUM PRATENSE. **Red clover.**

From Riga, Russia. Secured by Mr. E. A. Bessey from Mr. Fr. Lassmann, Riga, Russia. Received March 21, 1904.

10533.

From estate owned by Mr. Legsdin, Mohileff government, near Zhlobin.

10534. *Courland.*

From estate of Mr. Sillin, Neuhof, Courland government. A high-growing sort.

10535 to 10543. VICIA FABA. **Broad bean.**

From Paris, France. Received thru Vilmorin-Andrieux & Co., March 21, 1904.

10535. Large, common field variety.

10536. *Perfection.*

10537. *Sevilla*, long-podded.

10538. *Aguadulce*, extra long-podded.

10539. *Windsor.*

10540. *Green Windsor*, or *Genoa.*

10541. *Small Green Julienne.*

10542. *Dwarf Early.*

10543. *Beck's Gem*, green.

10544. **Bean.**

Originally from Spain. Received thru Mr. Rosendo Torras, of Brunswick, Ga., March 20, 1904.

Large white beans, slightly marked with red, varying in size. "Apparently different from any raised in this country." (*Torras.*)

10545. PHLEUM PRATENSE. **Timothy.**

From Vienna, Austria. Received thru Dr. Victor Lieb, Court Gardener to Palace of Miramar, near Trieste, Austria, March 24, 1904.

10546. PHLEUM PRATENSE. **Timothy.**

From Luleå, Sweden. Received thru Dr. Paul Hellström, March 24, 1904.

Grown at Persön Norrbattens Län, Sweden, in 1901. Imported for the experiments in the breeding of timothy at Ithaca, N. Y.

10547 to 10550. PHLEUM spp.

From Vienna, Austria. Received thru Doctor Weinzierl, Councilor, Seed Control Station in Vienna, March 24, 1904.

Four species of Phleum from the experiment station in the Austrian Alps, known as the Sandling-Alp Station, which has won a wide reputation for its work on forage crops and grasses in the Alps. These seeds were imported for breeding purposes, especially at the Cornell Experiment Station at Ithaca, N. Y.

10547. PHLEUM MEDIUM.

10548. PHLEUM ALPINUM.

10549. PHLEUM MICHELII.

10550. PHLEUM PRATENSE.

10551. (Undetermined.)

From Arcelia, Guerrero, Mexico. Presented by Mr. Federico Chisolm. Received March 26, 1904.

Seeds of a "blue-flowered perennial 12 to 18 inches high. Flowers 1¼ inches in diameter with yellow center. Ought to be used for bedding." (*Chisolm.*)

10552. TRITICUM VULGARE. **Wheat.**

From Sitka, Alaska. Grown at the Alaska Agricultural Experiment Station by Prof. C. C. Georgeson, from S. P. I. No. 1341 (?). Presented to the Secretary of Agriculture (probably in 1900) by Professor Georgeson.

10553 to 10556. CUCUMIS MELO. **Muskmelon.**

From Khojend, Russian Central Asia. Presented by Mr. E. Valneff to Mr. E. A. Bessey. Received March 28, 1904.

10553. *Ak Kuiriuk.*

10554. *Bosvaldi.*

10555. *Parsildak.*

10556. *Savnazik.*

10557. BLIGHIA SAPIDA. **Akee.**

From Hog Island, near Nassau, West Indies. Presented by Mrs. Ralph Johnson. Received March 25, 1904.

"The fruit of the akee, especially the arillus lying immediately below the seeds, is reported to be a delicious vegetable and to resemble in taste bits of sweetbread when cooked with meats or omelets. Worthy of attention in the Subtropical Gardens in Florida and a possibility as a culture in Porto Rico." (*Fairchild.*)

10558 to 10562. AMYGDALUS COMMUNIS. **Almond.**

Received thru Mr. J. W. Kerr, of Denton, Md., April 7, 1904

10558. *Castillet.*

Grown from S. P. I. No. 7133 (745).

10559. *Fabrica.*

Grown from S. P. I. No. 7135 (748).

10560. *Jordan.*

Grown from S. P. I. No. 7398 or No. 7401 (765 and 771).

10561. *Mollar.*

Grown from S. P. I. No. 7061 (740).

10562. *Planeta.*

Grown from S. P. I. No. 7062 or No. 7134 (741 and 746).

10563. TRIFOLIUM PRATENSE. **Red clover.**

From St. Petersburg, Russia. Secured by Mr. E. A. Bessey from Mr. G. Frick. Received April 11, 1904.

"Seed from Rjeschiza, Vitebsk government, in northwestern Russia. Should prove hardy." (*Bessey.*)

10564. TRIFOLIUM PRATENSE. **Red clover.**

From St. Petersburg, Russia. Secured by Mr. E. A. Bessey from Mr. G. Frick. Received April 11, 1904.

"Seed from Ekaterinburg, in Siberia. Climate very cold in winter." (*Bessey.*)

10565 to 10567. TRIFOLIUM spp. **Clover.**

From Russia. Presented by Prof. Charles E. Bessey, of the University of Nebraska. Received April 9, 1904.

Samples of clover seed collected by Professor Bessey in the summer of 1903, as follows:

10565. TRIFOLIUM LUPINASTER. **Five-leaf clover.**

10566. TRIFOLIUM sp.

10567. TRIFOLIUM HYBRIDUM. **Alsike.**

"Last summer I picked up several seeds of odd clovers which interested me very much, and I am wondering whether you may not wish to have them. One of these seeds is the five-foliate clover, which was given me by the professor in the Agricultural Institute of Moscow. Another resembles the common red clover, but is evidently distinguished from that species. I collected these seeds in the heart of the Caucasus Mountains, at an altitude of probably 6,000 feet. The exact locality is Kazbek. Another resembles the alsike clover and was obtained from the same locality as the last." (*Bessey.*)

10568. CYPERUS PAPYRUS. **Egyptian paper plant.**

From Washington, D. C. Presented by Mr. Peter Bisset, gardener of the Gardner Hubbard estate, "Twin Oaks," Washington, D. C. Received March 30, 1904.

10569. FAGOPYRUM ESCULENTUM. **Buckwheat.**

From Walhonding, Ohio. Presented by the originator, Mr. Charles L. Lonsinger, thru Hon. J. W. Cassingham, M. C. Received April 1, 1904.

The variety is described by Mr. Lonsinger, in his letter of February 23, 1904, to Mr. Cassingham, as follows:

"It is a variety of my own creation and it withstands hot weather better than any other variety. To determine this, I have been sowing it to have it filling during heat of summer. In this I had an excellent test the summer of 1901, when it filled while the thermometer registered 95° to 102° F. in the shade day after day. My motive was to get a heat-resisting variety, in which I am pleased with my success. What I claim for it is that it will produce plump grains in hot weather, when other varieties fail and the Japanese varieties shrivel beside it; that it will produce more per acre than Silverhull or Japanese buckwheat, and will double the yield of either in hot weather. It can be sown in spring and midsummer, or in ordinary seasons two crops can be grown.

"It grows a stout plant and stands up better than Silverhull. In a test with Silverhull, 2 bushels each by weight, it produced one-half pound more flour than Silverhull and cakes were of a milder flavor than cakes from Silverhull. Six pounds in chaff (5 pounds, estimated, clean seed), selected in 1902, and sown in spring of 1903 on ordinary ground and shaded on one side by timber, produced 454 pounds, or 9 bushels 4 pounds. In 1902 I sowed it July 5 and it was ripe September 10."

10570. SOLANUM TUBEROSUM. **Potato.**

From New York, N. Y. Presented by J. M. Thorburn & Co., seedsmen.

Earliest of All, a new seedling variety.

10571 to 10575.

From Arcelia, Guerrero, Mexico. Presented by Mr. Federico Chisolm. Received March 28, 1904.

A collection of bulbs and tubers, mostly unidentified.

10576. COCHLEARIA ARMORACIA. **Horse-radish.**

From Edgewater Park, N. J. Presented by Mr. B. D. Shedaker. Received April 13, 1904.

Maliner Kren. Roots grown from S. P. I. No. 5761.

10577. TRIFOLIUM PRATENSE. **Red clover.**

From Riga, Russia. Secured by Mr. E. A. Bessey from Mr. H. Goegginger. Received April 15, 1904.

"Red clover from Ufa, a dry region and cold in winter but having little snow. Seed rather poor, but for climatic regions ought to be valuable." (*Bessey.*)

10578. PHLEUM PRATENSE. **Timothy.**

From Tokyo, Japan. Presented by Dr. Oscar Loew, of Komaha Agricultural Experiment Station. Received April 13, 1904.

"Sample of seed for Mr. Gilmore's experiments in the selection of better races of timothy at the State Agricultural Experiment Station, Ithaca, N. Y. Furnished Doctor Loew by the Tokyo Plant Seed Company. The origin of the seed is uncertain. Presumably, however, it was gathered in Japan." (*Fairchild.*)

10579. EUTREMA HEDERAEFOLIA. **Dry-land wasabi.**

From Yokohama, Japan. Presented by Mr. H. Suzuki, of the Yokohama Nursery Company. Received April 18, 1904.

"This wasabi is said to grow well in ordinary dry soil in shade, but it being a native of the central part of Japan it might not resist your climate.

"It seems to be much easier of cultivation than the ordinary wasabi which we sent you before, tho it will take some years before it grows to the size of ordinary wasabi roots, but, as the leaves have a very good flavor, it is said to be eaten by the natives as one of the best kinds of spice. It is mostly growing wild and not in cultivation yet." (*Suzuki.*)

10580 to 10582. PRUNUS CERASUS. **Cherry.**

From Moscow, Russia. Secured by Mr. E. A. Bessey, thru Mr. Emil Meyer, head gardener of the Agricultural Institute. Received April 18, 1904.

10580. *Vladimir.*

10581. *Roditelsky.*

10582. *Vladimir.*

10583 to 10586. **Barley.**

From Svalöf, Sweden. Received thru the Allmänna Svenska Utsädesaktiebolaget (General Swedish Seed-Breeding Company), April 18, 1904.

"A collection of pedigreed brewing barleys, each one 100 per cent pure seed, which have been produced by selection at the Swedish Seed-Breeding Institute in Svalöf, under the direction of Dr. N. H. Nilsson. They are recommended for their remarkable uniformity of growth, their heavy yielding character, and the low nitrogen content of their kernels. Belonging to the two-rowed type of barley, they require to be kept longer on the growing floor or in the growing drum of the malt house, but in the opinion of European experts these pedigreed pure races of barley grow more uniformly and make a better quality of beer than the ordinary types of barley grown in America, which are all of mixed races. The different sorts represent practically pure types of Doctor Nilsson's various barley races and translations of his descriptions are given herewith." (*Fairchild.*)

10583. HORDEUM DISTICHUM NUTANS.

Prinsess. 0105. Head relatively thick and broad, with somewhat separated kernels and spreading awns. Before ripening, yellowish. Kernel finely built, medium in size, full, on both sides unusually finely wrinkled, yellow, with a slightly whitish tint. Plant strong, of medium height, thickly leaved, very well stooled, with strong, relatively stiff stems; leaves somewhat high on the stem. Medium late, ripening a few days later than the *Chevalier.* Extraordinarily productive, especially suited for mild, moderately strong, not too heavy soils. As a brewing barley, especially high prized. Belonging to Doctor Nilsson's Alpha group.

10584. HORDEUM DISTICHUM NUTANS.

Chevalier II. 0403. Head long, small, and loose, with kernels not divergent; never reddish colored. Kernel medium sized, full, and especially finely

10583 to 10586—Continued.

formed, finely wrinkled, and strongly yellow colored. Plant medium strong; leaves abundant, but placed low on the plants. Not very abundantly stooled, with somewhat weak culms. On account of this latter habit a variety especially suited to warm, light, not very heavy soils. Productivity, medium. Ripening time, not very early, but still a few days before the *Prinsess*. As a brewing sort, in suitable locations, much esteemed. Belonging to Doctor Nilsson's Alpha group.

10585. HORDEUM DISTICHUM NUTANS.

Hannchen. Head unusually thick for nodding barley; kernels not divergent and therefore the head is more compact, narrower, small, standing horizontally on the straight culm; light yellow in color before ripening. The awns are often thrown off. Kernel small, especially fine in form and color: light yellow, very finely wrinkled. Plant of peculiar habit, late starting into growth, but nevertheless very heavily stooling with several equally strong, graceful, but hard and very stiff culms which have few leaves, and these are near the ground. Ripens very early, little later than the *Swanneck*. Productiveness very good. Especially adapted for light, warm soils, and above all for high altitudes. Can stand well heavy manuring. As a brewing barley well qualified. It belongs to Doctor Nilsson's Alpha group.

10586. HORDEUM DISTICHUM ERECTUM.

Primus. 0706. Head rather long and relatively small, somewhat loosely built, with awns slightly spreading. Head borne on the culm, which is bent above almost horizontally. Kernel good, medium large, especially finely formed and full, finely wrinkled, rich yellow. Plant strong, moderately stooled, with upright very strong culms. Ripens early, scarcely perceptibly later in maturing (a day or so) than the *Hannchen*. Productiveness especially good. Quite certainly, so far as quality is concerned, the highest grade yet known among the "Imperial" barleys. Especially suited to heavy, cold loams and clay soils, such as are to be found in middle Sweden. Bred in the region where the sort already—thanks to its strong culms and earliness—has opened quite new regions for the culture of brewing barley.

10587. JUGLANS hyb. **Walnut.**

From Santa Ana, Cal. Received thru Mr. P. H. Dorsett, of Chico, Cal., April 18, 1904.

"I am sending you a tree which, as near as can at this time be determined, is a hybrid between the southern California black walnut and the native live oak. Native black-walnut seeds were planted as stocks, and these trees appeared in the rows. Walnut buds 'take' on these as readily as on the native stock, or even more readily." (*Dorsett.*)

10588. LOLIUM PERENNE. **Rye-grass.**

From The Hague, Holland. Presented by Mr. Berendsen, hortulanus of the Royal Zoological-Botanical Society. Received April 17, 1904.

Westerwoldicum. "A variety of rye-grass originated in the north of Holland, which has the reputation of being much superior in rapidity of growth and quantity of hay cut to that grown from the Scotch variety, which is sometimes planted here." (*Berendsen.*)

10589. PHLEUM PRATENSE. **Timothy.**

From The Hague, Holland. Presented by Mr. Berendsen, hortulanus of the Royal Zoological-Botanical Society. Received April 17, 1904.

"According to Mr. Berendsen the timothy seed used in Holland is usually imported from Scotland. This may be of Scotch origin. Imported for the timothy experiments conducted at the Cornell University Agricultural Experiment Station, Ithaca, N. Y." (*Fairchild.*)

10590 to 10597. Dioscorea spp. and Xanthosoma spp. **Yam and yautia.**

From San Juan, P. R. Presented by Miss Jenny H. Ericson. Received April 19, 1904.

A collection of Porto Rico yams and yautias not identified botanically. Yam culture in the West Indies is one of the most profitable small-plant industries. The botanical nomenclature of the various species is an important question.

10598 to 10614.

From Askhabad, Trans-Caspian territory, Turkestan. Secured by E. A. Bessey from Mr. A. Bashmakoff. Received April 22, 1904.

A collection of seeds and cuttings as follows:

10598 to 10609. Vitis vinifera. **Grape.**

10598. *Kara Kischmisch, Shiburgani,* or *Black Kishmish.*

Berry elongated oval, violet black, seedless, small, very sweet, producing a good red wine and also best *Black Kishmish* raisins; ripens in August.

10599. *Hussein Kara,* or *Black Huseïni.*

Differs from No. 10604 in its black color; ripens in July.

10600. *Halili ak,* or *White Khalili.*

Berry oval, conical, small, green covered with black dots, hard, of average taste; one of the earliest Asiatic sorts; ripens about the middle of June.

10601. *Daria.*

Berry spherical, or sometimes slightly elongated. Dark carmine with yellowish spots, sweet; a very early sort; ripens at Bairam Ali about the middle of June.

10602. *Bagishty.*

Berry large, spherical, very sweet, golden when ripe. This sort is good for table use and for jelly, etc.; is also a wine variety; ripens early in September.

10603. *Taifi.*

Berry elongated oval, obtuse at the apex, greenish color covered with dark carmine streaks and bloom, sweet; flesh very compact; when hung from the ceiling of a cool room it keeps the whole winter; has no superior for preserves and marmalade; ripens the middle of September.

10604. *Husseini ak,* or *White Huseïni.*

Berry white, at the time of ripening wax-colored, long, very sweet and juicy; the best table sort; ripens in June and July. (See No. 10290.)

10605. *Sahibi rosa,* or *Rosa Sakhabi.* (See No. 10305.)

10606. *Schokar ak,* or *White Shokar.*

10607. *Schiburchani,* or *Shiburkhani.*

10608. *Wassarga,* or *Vasarga.*

Berry large, comprest, spherical, with one or two furrows at the stalk, at maturity golden color, giving a good table wine; also good for making raisins.

10609. *Maska.*

Berry white, spherical, sometimes elongated, very large, reaching the size of a plum; used for the preparation of the best sorts of raisins; also for preserves; one of the most showy of the Central Asiatic sorts; ripens in July.

10610. Phaseolus radiatus. **Mung bean.**

Masch.

10598 to 10614—Continued.

10611. TRITICUM POLONICUM (?). **Wheat.**

Red Winter; unirrigated.

10612. ANDROPOGON SORGHUM (?). **Sorghum.**

Djugara.

10613. CHAETOCHLOA ITALICA. **Millet.**

Kunach, or *Kunak.*

10614. KOSTELETZKYA PENTACARPA.

Kanaf.

10615 to 10620. PERSEA GRATISSIMA. **Avocado.**

From Honolulu, Hawaii. Presented by Mr. Donald MacIntyre, Moanalua Gardens, Honolulu. Received April 22, 1904.

10615. *Large Purple.*

Flesh thick, of good, nutty flavor, yellow, and fiberless; seed comparatively small, about one-fourth of fruit; crop medium; pear-shaped; length and diameter over standard (4 by 6 inches). (No. 1.)

10616. *Small Green.*

Flesh not thick and with no nutty flavor, but quite fiberless and rather sweetish; fruit roundish, length in diameter about 4½ inches; late, heavy bearer, constant cropper. (No. 4.)

10617. *Large Green Round.*

Flavor good but not nutty; length and diameter about 5½ by 5 inches; crop uncertain. (No. 3.)

10618. *Large Green.*

Best of all in flavor; flesh smooth, firm, and fiberless; seed small; decidedly bottle-necked; length 7 inches, diameter about 4 inches; late cropper, but crop fairly constant; ripening about middle of June; seed small. (No. 6.)

10619. *Small Green.*

A very early variety, not of best flavor, with fiberless fruit; seed large; not decidedly pear-shaped; good grower and constant cropper; ripening about May 25; earliest variety in Honolulu. (No. 5.)

10620. *Large Green.*

Flavor decidedly nutty and good; flesh yellow, fiberless; length and diameter of fruit about standard; crop light, ripening about the middle of June. (No. 2.)

10621. PHLEUM PRATENSE. **Timothy.**

From Södermanland, Sweden. Presented by Prof. Jakob Eriksson, Experimentalfältet Albano, Stockholm. Received April 20, 1904.

"Sample of seed from crop of 1903 of Swedish timothy for the selection experiments carried on by Mr. John W. Gilmore at the Cornell University Agricultural Experiment Station." (*Fairchild.*)

10622. ARACHIS HYPOGAEA. **Peanut.**

From Japan. Presented by Prof. C. C. Georgeson, director of the Alaska Agricultural Experiment Station, Sitka, Alaska. Received April 18, 1904.

10623. CONVOLVULUS sp. **Japanese morning-glory.**

From Japan. Presented by Prof. C. C. Georgeson, director of the Alaska Agricultural Experiment Station, Sitka, Alaska. Received April 18, 1904.

Seed of Japanese morning-glories, which are known as being the most beautiful varieties in the world.

10624 to 10627.

From Moscow, Russia. Received from Immer & Sons, seedsmen, thru Mr. E. A. Bessey, April 23, 1904.

Seeds, as follows:

10624. AVENA SATIVA. **Oat.**

Belyak. A race of oat bred from the *Sväloff* oat and especially valuable in regions of limited rainfall, where it gives large crops when other sorts fail.

10625. PANICUM MILIACEUM. **Broom-corn millet.**

Orenburger. A low sort, especially bred for large yield in dry regions by the owner of a large estate. Not on the market. Obtained by Immer & Sons from the breeder as a personal favor to them.

10626. TRIFOLIUM PRATENSE. **Red clover.**

Red-clover seed from an estate at Kostroma, 150 miles north of Moscow, a region of very cold winters, almost at the edge of clover-seed production.

10627. TRIFOLIUM PRATENSE. **Red clover.**

Red-clover seed from an estate in the northern part of Simbirsk government, a region of cold winters with little snow.

10628. BETA VULGARIS. **Beet.**

From Catania, Sicily. Received thru Mr. Alwin Berger, La Mortola, Ventimiglia, Italy. Received April 21, 1904.

"Sample of beet seed from the director of the Royal Botanic Gardens in Catania for the breeding experiments of Dr. C. O. Townsend and Mr. E. C. Rittue, of this Department." (*Fairchild.*)

10629 and 10630. BETA MARITIMA.

From Sicily. Received thru Dr. Carl Sprenger, Vomero, near Naples, Italy, April 25, 1904.

"Sample of seed from two different localities in Sicily for the breeding experiments of Doctor Townsend and Mr. Rittue, of this Department. No. 10629 was marked 'I' and No. 10630 was marked 'II.' No further information." (*Fairchild.*)

10631. CAESALPINIA BREVIFOLIA. **Algarobillo.**

From New York. Received thru A. Klipstein & Co., 122 Pearl street, New York, N. Y., March 23, 1904.

Pods of the tannin shrub "algarobillo." This is a small tree found growing wild on the foothills of the Andes in Chile. It is said to occur in the driest portions of the arid coast and to produce large quantities of pods very rich in tannin. According to Dr. Louis E. Levi, of the Pfister & Vogel Leather Company, of Milwaukee, Wis., "it is an excellent tanning material, but gives a very light yellow color to the leather, which is partially objectionable, yet I think in mixtures with quebracho, or the like, it would answer the purpose of the tanner. The same contains about 50 per cent of tannin. The tannin material has as yet not been used very much in the United States on account of its objectionable color and easily fermentable properties when in solution. I think this is not very objectionable, as an experienced tanner would be able to get around this fault."

Mr. C. A. Spencer, importer and dealer in tanning materials, 183 Essex street, Boston, Mass., says: "Regarding the value of this material as a tanning agent, we may say its use for the purpose is very limited. While it is very strong in tannin it does not have the filling properties that make it a desirable material for the manufacture of leather, altho there is a limited quantity used in Great Britain and Europe, but from the best information we have been able to obtain, there are only about 1,000 tons yearly of this article available. As compared with other tanning materials grown in the United States, and with quebracho extract, gambier, etc., the price is somewhat higher, which no doubt accounts, to a certain extent, for its limited consumption. We formerly imported this article regularly, but the demand for it has grown much less during the past two years, and there are now practically but two consumers in this country of any size who are using the article in the manufacture of what they call gambier extract."

Mr. William H. Krug, of A. Klipstein & Co., 122 Pearl street, New York, N. Y., says: "We are unable to give you a comparative statement as to the value of this material as compared with the other tanning materials you mention in your letter, as it has been only very recently introduced in this country and has not received more than a very limited application. We believe with you that algarobillo can no doubt be successfully grown in some regions of the United States, and with the growing scarcity of domestic tanning materials, its introduction should prove of considerable interest."

10632. PERILLA OCYMOIDES. **Perilla.**

From Yokohama, Japan. Received thru the Yokohama Nursery Company April 25, 1904.

"Sent to replace the former quantity imported (see No. 9892), which failed to germinate." (*Fairchild.*)

10633. QUERCUS CORNEA. **Oak.**

From Hongkong, China. Presented by Mr. S. T. Dunn, superintendent of the Botanical and Afforestation Department. Received April 27, 1904.

"Acorns of an evergreen oak, said to be a very showy ornamental as grown on the island of Hongkong, but interesting particularly as bearing acorns as hard shelled as the nuts of the American hickory and which contain a kernel almost as sweet as the sweetest Spanish chestnut. These acorns are sold in the markets of Canton and Hongkong by the ton and are keenly relished not only by the Japanese but by Europeans. Altho difficult to predict how hardy this species will be in America, it is worthy of trial in all regions where citrus fruits can be grown." (*Fairchild.*)

10634. STACHYS SIEBOLDII. **Chinese artichoke.**

From London, England. Presented by Mrs. Theo. K. Gibbs, Bethshan, Gibbs avenue, Newport, R. I. Received April 29, 1904.

"These tubers are considered a great delicacy in France, where they are served in the best restaurants and command a good price. They are said to be more delicate than potatoes and are certainly worthy of a permanent place among the new vegetables of this country. They should be planted in rows a foot apart and 6 to 9 inches in the row as soon as all danger from frost is past. They mature their tubers in October, when they may be dug and stored in sand or earth in a cool place. They should be prepared by boiling, steaming, or roasting, and may be served either dry or with melted butter. Fried with salad oil they are considered to be especially delicious. Purchased by Mrs. Gibbs from Peter Barr, of London." (*Fairchild.*)

10635. PENTZIA VIRGATA. **Karoobosch.**

From Ward No. 3, Jansenville, South Africa. Received thru Messrs. Lathrop and Fairchild by arrangement with Dr. Charles P. Lounsbury and Mr. A. J. Davison, of the Department of Agriculture, Cape Town, South Africa, May 2, 1904.

"This fodder composite is considered of such great value by the sheep and cattle men of Cape Colony that a separate circular regarding it is being prepared. It is a low-growing, spreading bush which layers naturally when the tips of its branches arch over and touch the ground. In the eastern provinces of Cape Colony, where the rains occur in summer but where long, severe droughts are frequent, this Pentzia is one of the most valuable of all the Karroo plants for fodder purposes. It is especially good for sheep and goats, which eat it down almost to the ground. Tho tested unsuccessfully in Australia, the plant is of such great value that it deserves a thoro trial in the warmest parts of America and should be used in experiments on resuscitation of the barren island ranges of Hawaii." (*Fairchild.*)

10636 to 10669. MANGIFERA INDICA. **Mango.**

From Seharunpur, India. Presented by Mr. W. Gollan, superintendent of the Government Botanical Garden, to replace plants that died in transit last year. Received April 26, 1904.

THE PHILADELPHIA
APR 16 1907

10636 to 10639—Continued.

Plants as follows (notes by Mr. Gollan):

10636. *Arbuthnot.*

Something like *Bombay Yellow*, but a smaller fruit.

10637. *Brindabani.*

Medium-sized, green-colored fruit. Quality only fair.

10638. *Bombay Green.*

Something like *Bombay Yellow*, but fruit green when ripe.

10639. *Bombay Yellow.*

The best mango here. Fruit of medium size and yellowish when ripe.

10640. *Gopal Bhog.*

Medium-sized fruit. Keeps well. Flavor good.

10641. *Khapariah.*

A longish, hooked, pointed fruit. Color yellow, shaded red.

10642. *Salibunda.*

A large fruit. Subacid flavor. Color greenish yellow.

10643. *Strawberry.*

A longish, hooked, pointed fruit. Flavor good.

10644. *Calcuttia Amin.*

A long fruit, hooked, pointed. Has a very thin stone. Flavor good.

10645. *Faizan.*

A large, long fruit. Brownish green. Flavor good.

10646. *Fijri Long.*

A large, longish fruit. Ripens late. Dark green when ripe.

10647. *Fijri Round.*

Similar to above but of roundish shape.

10648. *Hathi Jhul.*

A very large fruit. Flavor good.

10649. *Kachmahua.*

A small fruit, but of good flavor.

10650. *Kakaria.*

A large, long fruit. Dark green. Good flavor.

10651. *Langra Hardoi.*

A medium-sized fruit. Ripens late. Pale yellow flesh. Very rich.

10652. *Surkha.*

A stringy kind, but of very good flavor.

10653. *Tamancha.*

A large fruit. Greenish yellow. Flavor good.

10654. *Bhadauria.*

A small, dark-green fruit. Ripens in September–October.

10655. *Punia.*

A medium-sized, stringy kind. Flavor very good.

10656. *Kistaphal.*

A large fruit. Flesh highly colored and of good flavor.

10636 to 10639—Continued.

10657. *Madras.*

A small fruit. Stringy but of fine flavor.

10658. *Romani.*

A medium-sized fruit. Subacid, of very fine flavor.

10659. *Nucka.*

A long, hooked, pointed fruit. Slightly stringy, but flavor good.

10660. *Chickna.*

A medium-sized fruit. Light yellow, of good flavor.

10661. *Davy's Favorite.*

A long, thin fruit. Yellow, shaded red.

10662. *Gola.*

A large, round, yellow fruit, of very good flavor.

10663. *Pyasee.*

A medium-sized fruit, of subacid flavor. Good.

10664. *Langra Large.*

Similar to *Langra Hardoi*, but larger. Ripens late in August.

10665. *Sundershah.*

A long fruit. Stringy. Flavor peculiar and only liked by some people.

10666. *Kala.*

A longish-shaped fruit. Pale green. Free of stringiness. Good.

10667. *Sanduriah.*

A small, long-shaped fruit. Stringy, but of fine flavor.

10668. *Naji Hahadi Amin.*

A medium-sized, dark-green fruit. Ripens late.

10669. *Sharhati Black.*

A large, round fruit. Dark green. Of very good flavor.

10670 to 10673. NEPHELIUM LITCHI and NEPHELIUM LONGANA.
Litchi and longan.

From Hing-hua, Fuhkien, China. Received thru Rev. W. N. Brewster, Methodist Episcopal missionary, in the autumn of 1903.

Mr. Brewster says: "They were grafted probably some time in the year 1902. The trees were not more than two years old, I think. With regard to the culture, they are not propagated from the seed, but a ball of earth is tied around a joint of a branch, and when it throws roots out into this ball the branch is cut off on the side next to the trunk, and the little tree is planted. The trees are fertilized by night soil about the time that they are blossoming and also later when the fruits begin to form. When the leaves are too thick, as they generally are in the spring, there is severe pruning done. After the buds are out, these are also thinned; after the blossoms begin to form into fruit they are thinned again. This is very important in order to make a perfect fruit. They must be kept entirely free from frost, and should be planted in a deep soil, i. e., the soil should be soft down many feet below the surface. The *litchi* blossoms early and matures the latter part of July. It is shaped like a strawberry and has the strawberry color and appearance, only the skin is rough and thick and brittle. The seed of the grafted variety is sharp pointed and small, and shriveled up so that the meat is much more abundant than in the ungrafted variety. The meat is white and juicy and a little tart. The *longan* (another species of the same genus) ripens in September. It is round and smooth. It is sweeter than the *litchi*, but the meat has very much the same appearance.

"The other fruit which I brought, the *longan*, is not a variety of the *litchi*, but a distinct fruit, different in color and taste, and matures several weeks later in the season. Many people think it is equal to, and some think it far superior to, the *litchi*. It is cultivated in the same way as the latter, so far as I have observed."

10674. Hordeum tetrastichum. **Four-row barley.**

From Chicago, Ill. Received thru Wahl-Henius Institute of Fermentology, May 3, 1904.

"Minnesota barley which, according to Dr. Robert Wahl's analysis, contains the unusual percentage of 15 to 16 per cent of protein. Doctor Wahl believes that this variety should be experimented with in connection with the testing of low-protein, two-rowed barleys. It is also of interest in connection with the experiments of Mr. H. M. Cottrell, Odebolt, Iowa, on high nitrogen feeding barleys." (*Fairchild.*)

10675 to 10723.

From Teneriffe, Canary Islands. Received thru Hon. Solomon Berliner, United States consul at Teneriffe, May 4, 1904. Transmitted thru the Secretary of State.

A collection of small samples of seeds, many of them indigenous to the Canary Islands, as follows:

10675. Asphodelus ramosus.
10676. Artemisia argentea.
10677. Bosea yervamora.
10678. Bystropogon origanifolius.
10679. Centaurea calcitrapa.
10680. Cineraria populifolia argentea.
10681. Chrysanthemum frutescens.
10682. Convolvulus althaeoides.
10683. Convolvulus floridus.
10684. Cytisus glabratus.
10685. Cytisus palmensis.
10686. Delphinium staphisagria.
10687. Digitalis canariensis.
10688. Dracaena draco.
10689. Dracunculus canariensis.
10690. Echium formosum.
10691. Echium simplex.
10692. Echium strictum.
10693. Euphorbia canariensis.
10694. Euphorbia regis-jubae.
10695. Ferula linkii.
10696. Galilea juncea.
10697. Genista canariensis.
10698. Genista monosperma.
10699. Gladiolus segetum.
10700. Gonospermum fruticosum.
10701. Gonospermum revolutum.
10702. Hypericum floribundum.
10703. Lavandula abrotanoides.
10704. Leucophae candidissima.
10705. Lotus canariensis floribunda.
10706. Mesembryanthemum crystallinum.
10707. Oenothera rosea.
10708. Parietaria arborea.
10709. Periploca laevigata.
10710. Pinus canariensis.
10711. Plocama pendula.
10712. Psoralea bituminosa.
10713. Ranunculus canariensis.
10714. Rhamnus crenulata.
10715. Rhodocistus berthelotianus.
10716. Rubia fruticosa.
10717. Rumex lunaria.
10718. Sempervivum tabulaeforme.
10719. Statice brassicaefolia.
10720. Statice pectinata.
10721. Tamus edulis.
10722. Teucrium hyssopifolium.
10723. Verbena bonariensis.

10724. VICIA FABA. **Horse bean.**

From Cairo, Egypt. Received thru Mr. George P. Foaden, secretary of the Khedivial Agricultural Society.

"Roots of this forage plant collected shortly before harvest time, dried in the shade, and mailed in tin mailing cases. For Doctor Moore's experiments in the isolation of the micro-organism which causes the tubercles." (*Fairchild.*)

10725. MEDICAGO ORBICULARIS.

From Algeria. Secured by Mr. Thomas H. Kearney in 1902. Turned over to this office by Mr. C. S. Scofield on May 5, 1904, to be numbered and sent to the Plant Introduction Garden at Chico, Cal., for propagation.

10726. PHLEUM PRATENSE. **Timothy.**

From Helsingfors, Finland. Received thru Mr. C. T. Ward, Finnish Horticultural Society, May 6, 1904.

Sample of timothy seed grown in Finland.

10727 to 10750.

From Monte, Grand Canary. Presented by Mr. Alaricus Delmard. Received May 6, 1904.

A collection of small samples of seeds of interesting plants growing in the Canary Islands, as follows:

10727. ADENOCARPUS FRANKENIOIDES.
10728. BOSEA YERVAMORA.
10729. BYSTROPOGON ORIGANIFOLIUS.
10730. CEDRONELLA CANARIENSIS.
10731. CHRYSANTHEMUM FRUTESCENS.
10732. CLETHRA ARBOREA.
10733. ISOLEPIS CANARIENSIS.
10734. CYTISUS PALMENSIS.
10735. DELPHINIUM STAPHISAGRIA.
10736. DIGITALIS CANARIENSIS.
10737. GALILEA JUNCEA.
10738. GONOSPERMUM REVOLUTUM.
10739. LEUCOPHAE CANDIDISSIMA.
10740. MESEMBRYANTHEMUM CRYSTALLINUM.
10741. OENOTHERA ROSEA.
10742. PARIETARIA ARBOREA.
10743. PERIPLOCA LAEVIGATA.
10744. RHODOCISTUS BERTHELOTIANUS.
10745. RUBIA FRUTICOSA.
10746. STATICE PECTINATA.
10747. TAMUS EDULIS.
10748. TEUCRIUM HYSSOPIFOLIUM.
10749. TRIXAGO VERSICOLOR.
10750. VERBENA BONARIENSIS.

10751. FRAGARIA sp. **Strawberry.**

From Garrettsville, Ohio. Presented by the originator, Mr. George J. Streator, for testing, on condition that no distribution is made. Received May 9, 1904.

Cardinal.

10752. ERVUM LENS. **Lentil.**

From Cairo, Egypt. Received thru Mr. George P. Foaden, secretary of the Khedivial Agricultural Society, May 6, 1904.

Saida. "A variety of an important crop grown extensively in Upper Egypt." (*Fairchild.*)

10753. VICIA FABA. **Horse bean.**

From Valetta, Malta. Received thru Dr. J. Borg, San Antonio Gardens, May 12, 1904.

Roots of a horse bean from the island of Malta, which, according to Doctor Borg, were from plants already in pod. Doctor Borg remarks that the nodules are not so plump as they were when the plant was just beginning to set fruit, and that the roots came from the best bean-producing lands in Malta, lands entirely free from orobanche, which is a bad weed in the bean fields and their worst enemy. "But for its ravages the bean would be the most profitable crop for agriculture." (*Borg.*)

10754. HORDEUM TETRASTICHUM. **Four-row barley.**

Originally from the Agricultural Experiment Station at Madison, Wis. Received thru the Wahl-Henius Institute of Fermentology, Chicago, Ill., May 9, 1904.

Oderbrucker. "A variety of barley which, upon analysis, proves to contain 15 per cent of protein matter. Dr. Robert Wahl considers it essential that this type of barley with high nitrogen content be experimented with for beer-making purposes, and Mr. H. M. Cottrell, of Odebolt, Iowa, is interested in it as a type especially adapted for feeding purposes." (*Fairchild.*)

10755 and 10756. CAPSICUM ANNUUM. **Paprika pepper.**

From Budapest, Hungary. Received thru Hon. Frank D. Chester, United States consul at Budapest, May 4, 1904.

Seeds of the two varieties of *paprika* which were requested by the Botanical Drug Company, of Bridgeport, Ala.

10755. *Szeged rose.*

From Szeged, Hungary.

10756. *Hungarian.*

From near Debreczen, Hungary.

"It is worthy of note that the best varieties of paprika are not imported into this country and that the highest priced, called 'Edelsüss,' brings 6 crowns a pound, while that generally imported into America is quoted at 1.65 crowns. There would seem to be a chance for the paprika industry in America." (*Fairchild.*)

10757 to 10958. PHOENIX DACTYLIFERA. **Date.**

From Biskra, Algeria. Purchased from Monsieur Colombo by correspondence conducted by Mr. W. T. Swingle. Plants paid for by Mr. E. A. Bessey, who superintended the packing and shipping to the United States. Received May 17, 1904.

10757 to 10832. *Deglet Noor.* From Ourlana oasis.

Among these palms there may be as many as four palms that are not *Deglet Noors*, since four lost their numbers and were confused with this lot of *Deglet Noors.* Nos. 10841, 10883, 10902, and 10904 are doubtful, and are probably *Deglet Noors.* The varieties of these four misplaced suckers are as follows: *Tezerharit*, *Abd en noor*, *Sokria*, and *Iteema.* These varieties are mostly quite unlike the *Deglet Noor* and can probably be recognized when the offshoots get of some size.

10833. *Deglet Beida.* From Ourlana oasis.

10834. *Deglet Beida.* From Ourlana oasis.

10835. *Deglet Beida.* From Ourlana oasis.

10836. *Tenaseen.* From Ourlana oasis.

10837. *Tenaseen.* From Ourlana oasis.

10838. *Tenaseen.* From Ourlana oasis.

10839. *Tezerharit.* From Ourlana oasis.

10840. *Tezerharit.* From Ourlana oasis.

10841. (No label.)

10757 to 10958—Continued.

10842. *Oreloo.* From Ourlana oasis.
10843. *Oreloo.* From Ourlana oasis.
10844. *Oreloo.* From Ourlana oasis.
10845. *Sayba Boo Dra.* From Ourlana oasis.
10846. *Sayba Boo Dra.* From Ourlana oasis.
10847. *Sayba Boo Dra.* From Ourlana oasis.
10848. *Sayba Boo Dra.* From Ourlana oasis.
10849. *Tafazweent.* From Ourlana oasis.
10850. *Tafazweent.* From Ourlana oasis.
10851. *Tafazweent.* From Ourlana oasis.
10852. *Taoorkhet.* From Ourlana oasis.
10853. *Taoorkhet.* From Ourlana oasis.
10854. *Taoorkhet.* From Ourlana oasis.
10855. *Taty.* From Ourlana oasis.
10856. *Taty.* From Ourlana oasis.
10857. *Taty.* From Ourlana oasis.
10858. *Timjoohert.* From Ourlana oasis.
10859. *Timjoohert.* From Ourlana oasis.
10860. *Timjoohert.* From Ourlana oasis.
10861. *Temkhookh.* From Ourlana oasis.
10862. *Temkhookh.* From Ourlana oasis.
10863. *Temkhookh.* From Ourlana oasis
10864. *Takadet.* From Ourlana oasis.
10865. *Takadet.* From Ourlana oasis.
10866. *Takadet.* From Ourlana oasis.
10867. *Taremoont.* From Ourlana oasis.
10868. *Taremoont.* From Ourlana oasis.
10869. *Taremoont.* From Ourlana oasis.
10870. *Nakhelet Mzian.* From Ourlana oasis.
10871. *Nakhelet Mzian.* From Ourlana oasis.
10872. *Nakhelet Mzian.* From Ourlana oasis.
10873. *Adebet et Teen.* From Ourlana oasis.
10874. *Adebet et Teen.* From Ourlana oasis.
10875. *Adebet et Teen.* From Ourlana oasis.
10876. *Makelet el Leef.* From Ourlana oasis.
10877. *Makelet el Leef.* From Ourlana oasis.
10878. *Makelet el Leef.* From Ourlana oasis.
10879. *Nakhelet Feraoon.* From Ourlana oasis.
10880. *Nakhelet Feraoon.* From Ourlana oasis.
10881. *Nakhelet Feraoon.* From Ourlana oasis.
10882. *Abd en Noor.* From Ourlana oasis.
10883. (No label.)
10884. *Abd en Noor.* From Ourlana oasis.
10885. *Horra.* From Fougala oasis.

10757 to 10958—Continued.

10886. *Horra.* From Fougala oasis.
10887. *Horra.* From Fougala oasis.
10888. *Rhazee.* From Fougala oasis.
10889. *Rhazee.* From Fougala oasis.
10890. *Rhazee.* From Fougala oasis.
10891. *Toory.* From Fougala oasis.
10892. *Toory.* From Fougala oasis.
10893. *Toory.* From Fougala oasis.
10894. *Oogbales.* From Fougala oasis.
10895. *Oogbales.* From Fougala oasis.
10896. *Oogbales.* From Fougala oasis.
10897. *Sokria.* From Biskra oasis.
10898. *Boo Halas.* From Biskra oasis.
10899. *Sokria.* From Biskra oasis.
10900. *Sokria.* From Biskra oasis.
10901. *Sokria.* From Biskra oasis.
10902. (No label.)
10903. *Iteema.* From Biskra oasis.
10904. (No label.)
10905. *M'Kentishee Degla.* From Biskra oasis.
10906. *M'Kentishee Degla.* From Biskra oasis.
10907. *M'Kentishee Degla.* From Biskra oasis.
10908. *Retbet Hafsia.* From Biskra oasis.
10909. *Retbet Hafsia.* From Biskra oasis.
10910. *Getara.* From Biskra oasis.
10911. *Getara.* From Biskra oasis.
10912. *Zoozia.* From Biskra oasis.
10913. *Retbet Regaya.* From Biskra oasis.
10914. *Retbet Regaya.* From Biskra oasis.
10915. *Retbet Regaya.* From Biskra oasis.
10916. *Mnooar* (male). From Filiache oasis.
10917. *Retbet Haloo.* From Filiache oasis.
10918. *Retbet Haloo.* From Filiache oasis.
10919. *Retbet Haloo.* From Filiache oasis.
10920. *Haloua.* From Biskra oasis.
10921. *Haloua.* From Biskra oasis.
10922. *Haloua.* From Biskra oasis.
10923. *Zerza.* From Biskra oasis.
10924. *Zerza.* From Biskra oasis.
10925. *Zerza.* From Biskra oasis.
10926. *Boo Halas.* From Biskra oasis.
10927. *Boo Halas.* From Biskra oasis.
10928. *Boo Halas.* From Biskra oasis.
10929. *Khodry.* From Biskra oasis.

10757 to 10958—Continued.

10930. *Khodry.* From Biskra oasis.
10931. *Khodry.* From Biskra oasis.
10932. *Lookzy.* From Filiache oasis.
10933. *Lookzy.* From Filiache oasis.
10934. *Rhazee.* From Filiache oasis.
10935. *Rhazee.* From Filiache oasis.
10936. *Rhazee.* From Filiache oasis.
10937. *Mnooar* (male). From Filiache oasis.
10938. *Mnooar* (male). From Filiache oasis.
10939. *Iteem Joher.* From Filiache oasis.
10940. *Iteem Joher.* From Filiache oasis.
10941. *Iteem Joher.* From Filiache oasis.
10942. *Goondy.* From Filiache oasis.
10943. *Goondy.* From Filiache oasis.
10944. *Goondy.* From Filiache oasis.
10945. *Lookzy.* From Filiache oasis.
10946. *Ahmar Msab.* From Chetma oasis.
10947. *Ahmar Msab.* From Chetma oasis.
10948. *Ahmar Msab.* From Chetma oasis.
10949. *Retbet Abdala.* From Chetma oasis.
10950. *Retbet Abdala.* From Chetma oasis.
10951. *Retbet Abdala.* From Chetma oasis.
10952. *Sokria.* From Chetma oasis.
10953. *Sokria.* From Chetma oasis.
10954. *Sokria.* From Chetma oasis.
10955. *Nesheen.* From Chetma oasis.
10956. *Nesheen.* From Chetma oasis.
10957. *Nesheen.* From Chetma oasis.
10958. (No label.)

10959. SECHIUM EDULE. **Chayote.**

From New Orleans, La. Received thru the J. Steckler Seed Company (Limited). Received May 10, 1904.

"Fruits of the commercial variety common in New Orleans markets." (*Fairchild.*)

10960. MANGIFERA INDICA. **Mango.**

From Tahiti. Received April 26, 1904.

"Seed of a fruit of a variety of mango brought by the captain of the steamer *Mariposa* to San Francisco. The captain declares it to be a superior variety, very free from fiber and very luscious. A fruit of this variety was eaten by Mr. George W. Oliver and he declares it an excellent variety. The captain says there are many trees of this variety in Tahiti. Owing to its large size and freedom from fiber it may prove valuable." (*Fairchild.*)

10961. (Undetermined.)

From Arcelia, Guerrero, Mexico. Presented by Mr. Federico Chisolm. Received May 5, 1904.

A small packet of flower seed. Flower described by Mr. Chisolm as follows: "Perennial blue flower, yellow center. Twelve inches to 20 inches. Blooms June, July, August, December, January, and February. Desirable for bedding."

10962. VICIA FABA. **Horse bean.**

From Tunis, Tunis. Received thru Mr. R. Gagey, Agricultural College, Tunis, May 17, 1904.

"Roots of horse bean, dried in the shade, for material from which to secure the micro-organism which forms the nitrogen-collecting nodules." (*Fairchild.*)

10963. LILIUM NEILGHERRENSE. **Neilgherry lily.**

From Utakamand, India. Presented by Mr. H. F. Macmillan, curator, Royal Botanic Garden, Peradeniya, Ceylon, thru Mr. Fairchild, May 20, 1904.

10964. GOSSYPIUM TOMENTOSUM. **Cotton.**

From Honolulu, Hawaii. Presented by Mr. Jared G. Smith, special agent in charge of the Agricultural Experiment Station, May 18, 1904.

10965. MUSA SAPIENTUM. **Banana.**

From Grand Canary, Canary Islands. Received thru Mr. Alaricus Delmard, May 20, 1904.

"Suckers of the so-called 'Chinese' banana, commonly grown in the Canary Islands and shipped to England in large quantities. It is reported that this variety of banana brings a higher price on the London market than the Jamaican or Central American varieties." (*Fairchild.*)

10966. LILIUM PHILIPPINENSE. **Lily.**

From Manila, P. I. Received from Mr. Elmer D. Merrill, botanist of the Bureau of Government laboratories, Manila, thru Capt. George P. Ahern, May 28, 1904.

"*Benguet* lily, introduced especially for experiments in hybridizing lilies." (*Fairchild.*)

10967. FURCRAEA FOETIDA.

From Port Luis, Mauritius. Presented by Mr. John W. Holway, United States vice-consul, to Mr. L. H. Dewey. Received May 10, 1904.

"My principal object in introducing them is to determine whether there is any difference between Porto Rico 'maguey' and Mauritius 'alser vert.'" (*Dewey.*)

10968. MAGNOLIA PUMILA. **Magnolia.**

From Canton, China. Presented by Mr. Thomas Griffith. Received May 23, 1904.

"Plants of an ornamental known in Canton as 'Yei-hap.' Said by Captain Bernadou, of the United States Navy, to be a great favorite among the Chinese, the flowers, which are fragrant, being used for boutonnieres. Occasionally cultivated in the South." (*Fairchild.*)

10969 to 10974.

Presented by Mr. Frederick Cramer, thru Dr. L. O. Howard. Received May 23, 1904.

10969. (Undetermined.) **Cactus.**

From the City of Mexico, Mexico.

"A low-growing species of cactus, the small berry-like cactus fruit of which is said to be edible. Probably comes from Michoacan." (*Fairchild.*)

10970. CITRUS AURANTIUM. **Orange.**

From Atotonilco, State of Jalisco, near Guadalajara, Mexico.

Telon. Said to be the very best seedling orange raised in southern Mexico. "Like a lemon but round like an apple. Sweet tasting." (*Fairchild.*)

10971.

From the City of Mexico, Mexico.

A collection of seeds secured by Mr. Cramer from all over Mexico, mostly of ornamental flowers, shrubs, and trees.

10969 to 10974—Continued.

10972. (Undetermined.)

From Guadalajara, Mexico.

Seeds of a medicinal plant.

10973. CICER ARIETINUM. **Chick-pea.**

From Mexico.

10974. CICER ARIETINUM. **Chick-pea.**

From Jalisco.

"Grown on dry, arid lands in the hotter portions of Mexico without irrigation. The weevils which attack this chick-pea are said to be injurious to other cereals. These seed should be carefully fumigated. Raised in Mexico on heavy, dry, black soil." (*Fairchild.*)

10975. CASTILLA sp. (?).

From Chiapas, Mexico. Presented by Mr. James Maunder, thru Dr. L. O. Howard. Received May 23, 1904.

Mr. Maunder considers this a valuable variety.

10976 and 10977.

From Quito, Ecuador. Presented by Mr. Luis Sodiro, S. J., a botanist and student of Ecuador agriculture. Received May 25, 1904.

10976. FESTUCA PABULARIS. **10977.** POA MULALENSIS.

"Mr. Sodiro remarks that Nos 10976 and 10977 are some of the most remarkable forage grasses of the mountain region of Ecuador. They are likely to prove of value in certain portions of this country." (*Fairchild.*)

10978. PERSEA GRATISSIMA. **Avocado.**

From Guatemala. Presented by Hon. Alfred A. Winslow, consul-general, Guatemala, Central America. Received May 23, 1904.

10979 to 10999.

From Hsi-an, China. Presented by Mr. W. W. Simpson in exchange for seeds of American vegetables sent him in December, 1903. Received May 23, 1904.

Seed as follows:

10979. CANNABIS SATIVA. **Hemp.**

10980.

A mixture, but labeled "Parsley."

10981. BRASSICA PE-TSAI. **Pe-tsai cabbage.**

10982. BRASSICA ALBA. **White mustard.**

10983. BRASSICA ALBA. **White mustard.**

10984. BRASSICA PE-TSAI. **Pe-tsai cabbage.**

10985. HORDEUM VULGARE. **Barley.**

10986. PISUM sp. **Pea.**

10987. PISUM SATIVUM. **Pea.**

10988. ALLIUM CEPA. **Onion.**

10989. BETA VULGARIS. **Beet.**

10990. RAPHANUS SATIVUS. **Spring radish.**

10991. VICIA FABA. **Broad bean.**

10992. TRITICUM VULGARE. **Winter wheat.**

10979 to 10999—Continued.

10993. TRIGONELLA FOENUM-GRAECUM. **Fenugreek.**

10994. BRASSICA PE-TSAI. **Pe-tsai cabbage.**

10995. APIUM GRAVEOLENS. **Celery.**

10996. LACTUCA SATIVA. **Lettuce.**

10997. BRASSICA PE-TSAI. **Pe-tsai cabbage.**

10998. LACTUCA SATIVA. **Lettuce.**

10999. LACTUCA SATIVA. **Lettuce.**

11000. PHLEUM PRATENSE. **Timothy.**

From Tokyo, Japan. Received from Mr. T. Watase, president of the Tokyo Plant, Seed, and Implement Company, thru Dr. Oscar Loew, Imperial University, Tokyo, May 31, 1904.

"Seed from Hakkaido, the northern island of Japan." (*Fairchild.*)

11001. NICOTIANA TABACUM. **Tobacco.**

From Sao Paulo, Brazil. Secured thru Dr. Horace M. Lane, president of the Mackenzie College. Received May 23, 1904.

Criolo.

11002. PANCRATIUM sp.

From Arcelia, Guerrero, Mexico. Presented by Mr. Federico Chisolm. Received June 6, 1904.

11003. PHOENIX DACTYLIFERA. **Date.**

From Biskra, Algeria. Received thru Monsieur Colombo by Mr. E. F. Chumard, of Imperial, Cal., Mr. E. A. Bessey, of this Department, acting as agent in the transaction, the previous correspondence having been conducted by Mr. Walter T. Swingle.

Deglet Noor.

11004 to 11009.

From Arcelia, Guerrero, Mexico. Received thru Mr. Federico Chisolm, June 15, 1904.

A collection of native Mexican seeds and bulbs as follows:

11004. PSIDIUM MOLLE. **Guayabilla.**

Strawberry-flavored guayabillas.

11005. PSIDIUM MOLLE. **Guayabilla.**

From fruits having at least four distinct flavors.

11006. SPONDIAS PURPUREA. **Ciruela.**

11007. SPONDIAS PURPUREA. **Ciruela.**

11008. LILIUM sp. (?). **Scarlet lily.**

11009. (Unidentified.)

11010 to 11017.

From Sepacuite, Guatemala. Received thru Mr. O. F. Cook, June 6, 1904.

11010. ANANAS SATIVUS. **Pineapple.**

A spiny-leaved pineapple peculiar to this immediate neighborhood, where it grows and ripens at a higher and cooler elevation than any other sort. The leaves are very broad and drooping, giving a very characteristic appearance. The flesh is yellow, and of moderately good quality, inferior to the best hot-country sorts, but better than the latter when grown in these humid highlands. It might be of use in the mountains of Porto Rico, Hawaii, or the Philippines.

11010 to 11017—Continued.

11011. ANANAS SATIVUS. **Pineapple.**

A smooth variety, not native here. Perhaps the Smooth Cayenne.

11012 to 11017. CHAMAEDOREA spp. **Palm.**

A collection of small palms which will be identified later.

11018. TRIFOLIUM PRATENSE. **Red clover.**

From Toledo, Ohio. Received thru S. W. Flower & Co., June 10, 1904.

11019. TRIFOLIUM HYBRIDUM. **Alsike.**

From Toledo, Ohio. Received thru S. W. Flower & Co., June 10, 1904.

11020. PRUNUS sp. **Plum.**

From Moody, Ala. Received thru Mr. D. S. Jones, June 9, 1904.

Yanner. "Bud sticks of a variety of wild plum which, according to Mr. Jones, ripens in Alabama about September 10. If house ripened the plums resemble in taste the *Wild Goose*, but are meatier. When taken from the tree they are bitter, but when mellowed they are excellent. This is a wild sort, probably of the family of the *Wild Goose*, and ripening so late that they are considered valuable for culinary purposes. Altho possibly known to other nurserymen, Mr. Jones does not find them cataloged by any nursery firm. The fruits are medium in size, deep red in color, and they are peculiarly free from disease, seldom being attacked by the curculio." (*Fairchild.*)

11021 to 11033.

From Buitenzorg, Java. Presented by Doctor Treub. Received June 15, 1904.

As follows:

11021. CALOPHYLLUM HASSKARLII.

11022. CALOPHYLLUM KUNSTLERI LONGIFOLIUM.

11023. CALOPHYLLUM SPECTABILE.

11024. CALOPHYLLUM SPECTABILE CERAMICUM.

11025. CALOPHYLLUM SPECTABILE MIQUELII.

11026. CALOPHYLLUM VENULOSUM.

11027. GARCINIA DIOICA.

11028. GARCINIA DULCIS PYRIFORMIS.

11029. GARCINIA DULCIS SYLVESTRIS.

11030. GARCINIA FUSCA.

11031. GARCINIA LOUREIRI.

11032. GARCINIA XANTHOCHYMUS.

11033. MESUA FERREA.

11034. PRUNUS CERASUS. **Cherry.**

From Moscow, Russia. Received thru Mr. E. A. Bessey, June 15, 1904.

Vladimir. Two-year-old trees (seedlings) of this resistant variety of cherry from the trial gardens of Immer & Son, Moscow.

11035 to 11038. NICOTIANA TABACUM. **Tobacco.**

From Sao Paulo, Brazil. Received thru Dr. Horace M. Lane, president of the Mackenzie College, June 9, 1904.

11035 to 11038—Continued.

Seed of four varieties of tobacco commonly grown in Brazil, as follows:

11035. *Americano fino.*

Grown in the interior of Bahia. The original stock probably came from the United States.

11036. *Bahiano.*

A native variety grown in Bahia, from which the celebrated Bahia leaf is made.

11037. *Santa Cruz.*

A native tobacco grown in Rio Grande do Sul. This sort is highly esteemed.

11038. *Turco.*

Grown around Sao Paulo for many years. The variety is of Asiatic origin.

11039 to 11119.

From Abyssinia, Africa. Received thru Hon. Robert P. Skinner, commissioner of the United States to Abyssinia, June 3, 1904.

"A collection of seeds made for Mr. Skinner, under his direction, by M. Eugène Carette Bouvet, of the Diré-Daoua, Voie de Djibouti, Côte Française des Somalis. This collection represents, in the main, crops cultivated by the Abyssinians." (*Fairchild*).

11039. Triticum durum.
11040. Hordeum sp.
11041. Hordeum sp.
11042. Hordeum sp.
11043. Hordeum sp.
11044. Hordeum sp.
11045. Gossypium sp.
11046. Gossypium sp.
11047. Gossypium sp.
11048. Gossypium sp.
11049. Triticum sp.
11050. Triticum sp.
11051. Triticum sp.
11052. Triticum sp.
11053. Triticum sp.
11054. Triticum sp.
11055. Phaseolus vulgaris.
11056. Phaseolus vulgaris.
11057. Phaseolus vulgaris.
11058. Andropogon sorghum.
11059. Andropogon sorghum.
11060. Andropogon sorghum.
11061. Andropogon sorghum.
11062. Andropogon sorghum.
11063. Andropogon sorghum.
11064. Andropogon sorghum.
11065. Andropogon sorghum.
11066. Andropogon sorghum.
11067. Andropogon sorghum.
11068. Ricinus sp.
11069. Ricinus sp.
11070. Ricinus sp.
11071. Ricinus sp.
11072. Ricinus sp.
11073. Ricinus sp.
11074. Vigna sinensis.
11075. Vigna sinensis.
11076. Vigna sinensis.
11077. Coriandrum sativum.
11078. Coffea sp.
11079. Linum usitatissimum.
11080. Ervum lens.
11081. Brassica oleracea.
11082. Andropogon sorghum.
11083. Andropogon sorghum.
11084. Andropogon sorghum.
11085. Andropogon sorghum.
11086. (Unidentified.)
11087. Trigonella foenum-graecum.
11088. Trigonella foenum-graecum.
11089. (Unidentified.)
11090. Vigna sinensis.
11091. Vigna sinensis.
11092. (Unidentified.)
11093. Guizotia oleifera.

11039 to 11119—Continued.

11094. Triticum dicoccum.
11095. Cicer arietinum.
11096. Lepidium sativum.
11097. Pisum sativum.
11098. Phaseolus radiatus.
11099. Triticum durum.
11100. Eleusine coracana..
11101. Coriandrum sativum.
11102. Vicia faba.
11103. Vicia faba.
11104. (Unidentified.)
11105. Ervum lens.
11106. Zea mays.
11107. Guizotia oleifera.
11108. Capsicum frutescens.
11109. Cicer arietinum.
11110. Cicer arietinum.
11111. Pisum sp.
11112. Pisum sp.
11113. Linum usitatissimum.
11114. Centaurea sp.
11115. Carthamus tinctorius.
11116. Hordeum sp.
11117. Eragrostis abyssinica.
11118. Eragrostis abyssinica.
11119. Andropogon sorghum.

11120 to 11127.

From Santa Barbara, Cal. Received thru Dr. F. Franceschi, June 20, 1904.

A collection of plants for experimental work carried on in cooperation with Prof. Haven Metcalf, of the South Carolina Agricultural Experiment Station, Clemson, S. C.

11120. Passiflora coerulea.
11121. Passiflora edulis.
11122. Passiflora pfordii.
11123. Passiflora manicata.
11124. Passiflora acerifolia.
11125. Passiflora ligularis.
11126. Passiflora alata.
11127. Tacsonia exoniensis.

11128. Phoenix dactylifera. **Date.**

From Fayum, Egypt. Received thru Mr. H. A. Rankin, of the Egyptian Market Company (Limited), June 21, 1904.

Wahi.

11129 to 11236.

Miscellaneous seed on hand July 1, 1904. Numbered to facilitate the keeping of record of distribution.

11129. Agropyron tenerum. **Slender wheat-grass.**

From Northrup, King & Co., Minneapolis, Minn.

11130. Agrostis alba. **Redtop.**

11131. Andropogon halepensis. **Johnson grass.**

11132 to 11136. Andropogon sorghum. **Sorghum.**

11132. *Colman.*
11133. *Amber.*
11134. *Folger.*
11135. *Kansas Orange.*
11136. *Collier.*

11137. Andropogon sorghum. **Kafir corn.**

White.

11138. Andropogon sorghum. **Milo.**

White.

11139. Anthoxanthum odoratum. **Sweet vernal grass.**

11129 to 11236—Continued.

11140. ARACHIS HYPOGAEA. **Peanut.**

Spanish. Received March 25, 1904.

11141. ARRHENATHERUM ELATIUS. **Tall meadow oat-grass.**

11142. ATRIPLEX SEMIBACCATA. **Saltbush.**

Received from the California Experiment Station.

11143. ARRHENATHERUM ELATIUS. **Tall meadow oat-grass.**

11144 to 11151. AVENA SATIVA. **Oat.**

11144. *Banner.*
11145. *Burt.*
11146. *California White.*
11147. *Dakota Gray.*
11148. *Green Mountain.*
11149. *Hopetown.*
11150. *Improved American.*
11151. *Swiss White.*

11152 to 11163. BETA VULGARIS. **Sugar beet.**

11152. *Kleinwanzleben.*

From Utah Sugar Refining Company, Lehi, Utah. (Seed Lab. No. 12846.)

11153. *Kleinwanzleben.*

From H. C. & J. B. Agnew, Agnew, Cal. (Seed Lab. No. 12848.)

11154.

From E. H. Morrison, Fairfield, Wash. (Seed Lab. No. 13007.)

11155. *Kleinwanzleben Nachzucht.*

From H. Bennecke & Son, Germany.

11156.

From the Alma Sugar Company, Alma, Mich.

11157.

From France.

11158. *Kleinwanzleben.*

11159. *Mangel-wurzel.*

11160. *Kleinwanzleben.* (Michigan grown.)

From Pennsylvania Sugar Refinery.

11161. *Hoerning's Improved Kleinwanzleben Special Elite.*

11162.

From Utah Sugar Company, Lehi, Utah. Crop of 1901. (Seed Lab. No. 12756.)

11163.

From H. C. & J. B. Agnew, Agnew, Cal. (Seed Lab. No. 12790.)

11164. ANDROPOGON SORGHUM. **Broom corn.**

Tennessee Evergreen.

11165. BRASSICA NAPUS. **Rape.**

Dwarf Essex.

11166. BROMUS INERMIS. **Smooth brome-grass.**

11167. BROMUS UNIOLOIDES. **Rescue grass.**

From J. M. Thorburn & Co., 36 Cortlandt street, New York, N. Y.

11168. CHAETOCHLOA ITALICA. **German millet.**

11169. CAPRIOLA DACTYLON. **Bermuda grass.**

11170. CICER ARIETINUM. **Chick-pea.**

11129 to 11236—Continued.

11171. DACTYLIS GLOMERATA. **Orchard grass.**

11172. EUCHLAENA MEXICANA. **Teosinte.**

11173. FAGOPYRUM ESCULENTUM. **Buckwheat.**

11174. FESTUCA ELATIOR. **Tall fescue.**

11175. FESTUCA HETEROPHYLLA. **Various-leafed fescue.**

11176. FESTUCA OVINA. **Sheep's fescue.**

11177. FESTUCA PRATENSIS. **Meadow fescue.**

11178. FESTUCA RUBRA. **Red fescue.**

11179. GLYCINE HISPIDA. **Soy bean.**

Early Black.

11180. GLYCINE HISPIDA. **Soy bean.**

Yellow.

11181 to 11186. GOSSYPIUM BARBADENSE. **Egyptian cotton.**

11181. *Mit Afifi.* (Plant Breeding No. 56.)
11182. *Jannovitch.* (Plant Breeding No. 63.)
11183. *Ashmuni.* (Plant Breeding No. 59.)
11184. *Mit Afifi.* (Plant Breeding No. 55.)
11185. *Ashmuni.* (Plant Breeding No. 62.)
11186. *Ashmuni.* (Plant Breeding No. 61.)

11187 to 11190. GOSSYPIUM sp. **Cotton.**

11187. (No label.)
11188. *King.*
11189. *Rivers.*
11190. *Upland.*

11191. HELIANTHUS ANNUUS. **Sunflower.**

Received from the Division of Chemistry in 1901.

11192. HORDEUM VULGARE. **Barley.**

Manchurian. From the Minnesota Agricultural Experiment Station. (Minn. No. 105.)

11193. HORDEUM VULGARE. **Barley.**

Tennessee Winter. From the Tennessee Agricultural Experiment Station.

11194. LATHYRUS STIPULARIS.

11195. LATHYRUS AZUREUS.

11196. LATHYRUS COCCINEUS.

11197. LATHYRUS SATIVUS. **Bitter vetch.**

11198. LATHYRUS SATIVUS. **Bitter vetch.**

Received from C. C. Morse & Co., Santa Clara, Cal.

11199. LATHYRUS SATIVUS. **Bitter vetch.**

From Agricultural Experiment Station, Berkeley, Cal.

11200. LATHYRUS TINGITANUS. **Tangier scarlet pea.**

From C. C. Morse & Co., Santa Clara, Cal.

11201. LESPEDEZA STRIATA. **Japan clover.**

11202. LOLIUM ITALICUM. **Italian rye-grass.**

11203. LOLIUM PERENNE. **Perennial rye-grass.**

11204. LOTUS CORNICULATUS. **Bird's-foot trefoil.**

11129 to 11236—Continued.

11205. Lupinus affinis. **Blue lupine.**

11206. Lupinus angustifolius. **Blue lupine.**

11207. Lupinus luteus. **Yellow lupine.**

11208. Medicago denticulata. **Bur clover.**

11209. Medicago sativa. **Alfalfa.**

11210. Medicago sativa. **Alfalfa.**

11211. Medicago sativa. **Alfalfa.**

Turkestan. From Henry Nungesser & Co., New York, N. Y.

11212. Melilotus alba. **Sweet, or Bokhara, clover.**

11213. Mucuna utilis. **Velvet bean.**

11214. Pennisetum typhoideum. **Pearl millet.**

11215. Phleum pratense. **Timothy.**

11216. Pisum arvense. **Canada field pea.**

11217. Poa pratensis. **Kentucky bluegrass.**

11218. Secale cereale. **Rye.**

11219. Secale cereale. **Rye.**

Winter.

11220. Chaetochloa italica. **Hungarian grass.**

11221. Trifolium alexandrinum. **Berseem.**

From C. C. Morse & Co., Santa Clara, Cal.

11222. Trifolium hybridum. **Alsike.**

11223. Trifolium incarnatum. **Crimson clover.**

11224. Trifolium pratense. **Red clover.**

11225. Trifolium repens. **White clover.**

11226 to 11229. Triticum vulgare. **Wheat.**

11226. *Zimmerman.* **11228.** *Preston* (Spring).

11227. *Budapest.* **11229.** *Turkey.*

From the Agricultural Experiment Station, Manhattan, Kans.

11230. Vicia bithynica.

11231. Vicia fulgens. **Scarlet vetch.**

11232. Vicia narbonnensis. **Narbonne vetch.**

11233. Vicia sativa. **Common vetch.**

11234. Vicia villosa. **Hairy vetch.**

11235. Vicia villosa. **Hairy vetch.**

Inoculated April 16, 1904.

11236. Vigna sinensis. **Cowpea.**

Warren. From Professor Newman, Agricultural Experiment Station, Fayetteville, Ark.

11237 to 11251. Beta vulgaris. **Sugar beet.**

Seed from 1903 crop remaining on hand July 1, 1904, after the distribution made by Mr. J. E. W. Tracy. Previous distribution recorded under these numbers.

11237. *Kleinwanzleben.*

From Klein Wanzleben Sugar Company, Klein Wanzleben, Germany. (Tracy's No. 12853.)

11238. *Schreiber's Specialität.*

From G. Schreiber & Sons, Nordhausen, Germany. (Tracy's No. 12854.)

11237 to 11251—Continued.

11239. From Lehi Sugar Company, Lehi, Utah. (Tracy's No. 12856.)

11240. *Elite Kleinwanzleben.*
From the Empire Sugar Company, Lyons, N. Y. Originally from Dippe Brothers, Quedlinburg, Germany. (Tracy's No. 12857.)

11241. *Kleinwanzleben.*
From the Empire Sugar Company, Lyons, N. Y. Originally from Kuhn & Co., Naarden, Holland. (Tracy's No. 12858.)

11242. *Kleinwanzleben.*
From the Empire Sugar Company, Lyons, N. Y. Originally from F. Heine, Hadmersleben, Germany. (Tracy's No. 12859.)

11243. *Kleinwanzleben.*
From the American Beet Sugar Company, Grand Island, Nebr. (Tracy's No. 12860.)

11244. *Kleinwanzleben.*
From the Sanilac Sugar Refining Company, Croswell, Mich. Originally from Orro Hoerning, Eisleben, Germany. (Tracy's No. 12862.)

11245. *Kleinwanzleben.*
From the Sanilac Sugar Refining Company, Croswell, Mich. Originally from Henry Mette, Quedlinburg, Germany. (Tracy's No. 12863.)

11246. *Jaensch Victrix.*
From the Sanilac Sugar Refining Company, Croswell, Mich. Originally from Gustav Jaensch, Aschersleben, Germany. (Tracy's No. 12864.)

11247. *Knauer's Mangold.*
From the Sanilac Sugar Refining Company, Croswell, Mich. Originally from M. Knauer, Grobers, Germany. (Tracy's No. 12765.)

11248. *Aderstadt.*
From the Sanilac Sugar Refining Company, Croswell, Mich. Originally from M. Knauer, Grobers, Germany. (Tracy's No. 12866.)

11249. *Kleinwanzleben.*
From the Menominee River Sugar Refining Company, Menominee, Mich. Originally from the Klein Wanzleben Sugar Factory, Klein Wanzleben, Germany. (Tracy's No. 12867.)

11250. *Elite Kleinwanzleben.*
From the Menominee River Sugar Refining Company, Menominee, Mich. Originally from Otto Bruenstedt, Schladenam-Hartz, Germany. (Tracy's No. 12868.)

11251. *Elite Kleinwanzleben.*
From Menominee River Sugar Refining Company, Menominee, Mich. Originally from C. Braune, Biendorf, Germany. (Tracy's No. 12869.)

11252 to 11258.

Plants and seeds presented to or secured by Mr. P. H. Dorsett for planting at the Plant Introduction Garden, Chico, Cal.

11252. JUGLANS CALIFORNICA × QUERCUS (?).

Presented by Mr. S. M. Desher, Garden Grove, Cal.

"This is one of a number of trees from a planting made for grafting stock about two years ago." (*Dorsett.*)

11253. JUGLANS NIGRA. **Black walnut.**

Nuts from Mr. Ewing D. Johnson's farm, near Rockbridge, southeast of Columbia, Mo.

11254. HICORIA sp. **Hickory.**

Small hickory nuts from Mr. Ewing D. Johnson's farm, near Rockbridge, southeast of Columbia, Mo. Secured in February, 1904.

11255. AMYGDALUS hyb. **Peach almond.**

Seeds from G. W. H. fruit ranch. Received October 22, 1903.

11252 to 11258—Continued.

11256. HICORIA sp. **Hickory.**

Large hickory nuts from Wolfskill Ranch, Yolo County, Cal. Received October 10, 1903.

11257. JUGLANS CINEREA. **Butternut.**

Nuts from Wolfskill Ranch, Yolo County, Cal. Received October 25, 1903.

11258. CEDRUS LIBANI. **Cedar of Lebanon.**

Seed from an avenue of trees near Pasadena, Cal. Presented by Mr. C. R. Lukins, Pasadena, Cal.

11259 to 11262.

From Hacienda "La Trinidad," Arcelia, Guerrero, Mexico. Presented by Mr. Federico Chisolm. Received June 24, 1904.

A collection of unidentified Mexican bulbs.

11263. GOSSYPIUM HERBACEUM. **Cotton.**

From Valetta, Malta. Presented by Dr. Giovanni Borg. Received June 20, 1904.

Maltese. "Seed of the old Maltese cotton, which, according to Doctor Borg, has been cultivated in Malta since the times of the Phoenicians, three thousand years ago. This is an early-ripening sort, maturing its bolls in August or September. It is a very hardy sort, of low habit, and flowers and sets with bolls when quite young. Doctor Borg says it should be sown rather thick and that it is a very productive sort. The fiber is rather short, altho very strong and elastic. Introduced as of possible use in the experiments against the boll weevil because of its early-ripening habit." (*Fairchild.*)

11264 to 11268.

From Geneva, Idaho. Received thru Mr. F. W. Boehme, June 23, 1904.

A collection of grains adapted to high altitudes, as follows:

11264. HORDEUM VULGARE. **Barley.**

Beardless.

11265. HORDEUM VULGARE. **Barley.**

Beardless and hull-less.

11266. TRITICUM VULGARE. **Wheat.**

Spring wheat.

11267. LINUM USITATISSIMUM. **Flax.**

11268. SECALE CEREALE. **Rye.**

Spring rye.

11269. HYPHAENE CRINITA. **Doum palm.**

From Upper Egypt. Received thru Mr. T. H. Kearney, June 15, 1904.

"Botanically this is one of the most interesting palms in the world, as, unlike almost all others, it has a branching stem. It is suited to a frostless and exceptionally dry region and may succeed in the warmest and driest portions of this country. The fruits, which are produced in large clusters, are used for food by the poorer classes, the part eaten being the fibrous, mealy husk, which tastes something like gingerbread, and for this reason is called the "gingerbread tree" of Egypt. A drink called "coca" is also made from this fibrous husk and the large, yellowish brown, beautifully polished fruits of this palm." (*Kearney.*)

11270 to 11274.

From Jalapa, Mexico. Presented by Mr. Frank N. Meyer to Mr. G. W. Oliver. Received June 23, 1904.

Seeds of five wild Mexican plants, mostly unidentified.

11275. MEDICAGO SATIVA. **Alfalfa.**

From Chicago, Ill. Received thru the Albert Dickinson Company, June 28, 1904. (Ordered by sample "Cabin.")

11276. TRIFOLIUM REPENS. **White clover.**

From Chicago, Ill. Received thru the Albert Dickinson Company, June 28, 1904. (Ordered by sample "Boil.")

11277 to 11341. PHOENIX DACTYLIFERA. **Date.**

From Orléansville, Algeria. Received thru Yahia ben Kassem, July 5, 1904. Sixty-five date palms, all from the Mzab oasis.

11277. *Deglet Noor.*
11278. *Deglet Noor.*
11279. *Deglet Noor.*
11280. *Rhars.*
11281. *Rhars.*
11282. *Rhars.*
11283. *Hamraya.*
11284. *Hamraya.*
11285. *Hamraya.*
11286. *Tadala.*
11287. *Tadala.*
11288. *Tadala.*
11289. *Tadala.*
11290. *Tadala.*
11291. *Tadala.*
11292. *Tadala.*
11293. *Tadala* (?).
11294. *Bent Kebala.*
11295. *Bent Kebala.*
11296. *Bent Kebala.*
11297. *Bent Kebala.*
11298. *Bent Kebala.*
11299. *Bent Kebala.*
11300. *Bent Kebala.*
11301. *Bent Kebala.*
11302. *A' Ooshet.*
11303. *A' Ooshet.*
11304. *A' Ooshet.*
11305. *Kseba.*
11306. *Kseba.*
11307. *Kseba.*
11308. *Kerboosh.*
11309. *Kerboosh.*
11310. *Kerboosh.*
11311. *Kerboosh.*
11312. *Tafazween.*
11313. *Tafazween.*
11314. *Tafazween.*
11315. *Timjoohert.*
11316. *Timjoohert.*
11317. *Timjoohert.*
11318. *Timjoohert.*
11319. *Timjoohert.*
11320. *Timjoohert.*
11321. *Timjoohert.*
11322. *Timjoohert.*
11323. *Timjoohert.*
11324. *Timjoohert.*
11325. *Timjoohert.*
11326. *Tamzoohart.*
11327. *Tamzoohart.*
11328. *Taoorarhet.*
11329. *Taoorarhet.*
11330. *Taoorarhet.*
11331. *Lazerza.*
11332. *Tazeza' oot.*
11333. *Tazeza' oot.*
11334. *Tazeza' oot.*
11335. *Toojat.*
11336. *Toojat.*
11337. *Toojat.*
11338. *Sebaa Loosif.*
11339. *Sebaa Loosif.*
11340. (No label.)
11341. *Tazaga' at.*

11342. NEPHELIUM LITCHI. **Litchi.**

From Trinidad, British West Indies. Received July 2, 1904.

11343. GOSSYPIUM BARBADENSE. **Cotton.**

From Valetta, Malta. Presented by Dr. Giovanni Borg. Received July 5, 1904.

"An Egyptian variety which Doctor Borg has been trying to improve on the island of Malta. Introduced for the experiments in connection with the boll weevil." (*Fairchild.*)

11344. VIGNA SINENSIS. **Cowpea.**

From West Branch, Mich. Received thru Edw. E. Evans Seed Company, July 8, 1904.

Michigan Favorite. Said by Mr. Evans to be the earliest sort known; ripens seed every year in Michigan.

11345 to 11353.

From Guerrero, Mexico. Received thru Mr. Federico Chisolm, July 9, 1904.

Native Mexican bulbs, not identified.

11354. COFFEA sp. **Coffee.**

From Abyssinia, Africa. Presented by Hon. Robert P. Skinner, American consul-general at Marseille, France. Received July 11, 1904.

Harrar. Probably a wild variety from Abyssinia.

11355 to 11368. BETA VULGARIS. **Sugar beet.**

Seed from 1903 crop remaining on hand July 1, 1904, after the distribution made by Mr. J. E. W. Tracy. Previous distribution recorded under these numbers.

11355. *Schreiber's Specialität.*

From the Menominee Sugar Refining Company, Menominee, Mich. Originally from G. Schreiber & Sons, Nordhausen, Germany. (Tracy's No. 12870.)

11356. *Kleinwanzleben.*

From H. C. & J. B. Agnew, Agnew, Cal. (Tracy's No. 12871.)

11357. *Kleinwanzleben.*

From Metz & Co., Streglitz, near Berlin, Germany.

11358. From M. Knauer, Grobers, Germany. Marked 7300.

11359. From M. Knauer, Grobers, Germany. Marked 7301.

11360. *Kleinwanzleben.*

From Carl Schobert & Co.

11361. *Elite Kleinwanzleben.*

From G. Schreiber & Sons, Nordhausen, Germany.

11362. *Kleinwanzleben.*

From E. H. Morrison, Fairfield, Wash. Purchased in 1902 for the Congressional seed distribution.

11363. *Kleinwanzleben.*

From E. H. Morrison, Fairfield, Wash. (Tracy's No. 12855.)

11364. *Kleinwanzleben.*

From C. C. Morse & Co., Santa Clara, Cal. (Tracy's No. 12861.)

11365. (Tracy's No. 12844.)

11366. (Tracy's No. 12847.)

11367. (Tracy's No. 12849.)

11368. (Tracy's No. 12850.)

11369. MANGIFERA INDICA. **Mango.**

From the Government Botanic Gardens, Seharunpur, India. Presented by Mr. Robert Anderson, Lansdowne, Pa., for propagation. Received February 25, 1904.

Buds of the *Langra* mango.

11370 and 11371.

Seed on hand July 1, 1904, numbered for convenience of recording distribution.

11370. VIGNA SINENSIS. **Cowpea.**

Iron. From Mr. T. S. Williams, Monetta, S. C.

11371. ANDROPOGON SORGHUM. **Sorghum.**

Early Amber. From Mr. Seth Kenney, Morristown, Minn.

11372 to 11477. VITIS sp. **Grape.**

From Thomery, France. Received thru E. Salomon & Sons, and shipped direct to Niles, Cal.

11372. *Rupestris Martin.*
11373. *Riparia Grand Glabre × Aramon-Rupestris 4110.*
11374. *Pinot × Rupestris 1305.*
11375. *Rupestris de Semis 81–2.*
11376. *Mourvedre × Rupestris 1202.*
11377. *Riparia France.*
11378. *Rupestris × Berlandieri 301–37–152.*
11379. *Monticola × Riparia 18804.*
11380. *Monticola × Riparia 18815.*
11381. *Chasselas × Berlandieri 41 B.*
11382. *Cabernet × Rupestris Ganzin 33 A.*
11383. *Bourisquou × Rupestris 4306.*
11384. *Monticola × Riparia 18808.*
11385. *Rupestris × Berlandieri 301 A.*
11386. *Riparia × Rupestris-Aramon-Jaeger 201.*
11387. *Riparia × Berlandieri 161–49.*
11388. *Riparia × Rupestris 3306.*
11389. *Viala.*
11390. *Bourisquou × Rupestris 3907.*
11391. *Berlandieri × Riparia 420 A.*
11392. *Rupestris × Berlandieri 219 A.*
11393. *Bourisquou × Rupestris 109–4.*
11394. *Bourisquou × Rupestris 4308.*
11395. *Viala × Riparia.*
11396. *Berlandieri × Riparia 420 B.*
11397. *Rupestris × Riparia 1615.*
11398. *Riparia du Colorado.*
11399. *Riparia × Rupestris 101–14.*
11400. *Berlandieri × Riparia 33 E. M.*
11401. *Rupestris × Riparia 108–16.*

11372 to 11477—Continued.

11402. *Berlandieri Lafont No. 9.*

11403. *Alicante Bouschet* × *Riparia 141 A.*

11404. *Aramon* × *Rupestris Ganzin 9.*

11405. *Aestivalis-Calicola* × *Riparia-Rupestris 554-5.*

11406. *Berlandieri No. 1.*

11407. *Berlandieri No. 2.*

11408. *Berlandieri* × *Riparia 157-11.*

The following vines were received at Niles, April 11, 1904:

11409. *Cordifolia* × *Riparia 127-1* (?).

11410. *Rupestris* × *Cinerea.*

11411. *Rupestris* × *Cordifolia 107-11.*

11412. *Rupestris* × *Hybrid Azemar 215.*

11413. *York* × *Rupestris Ganzin 202.*

11414. *York* × *Rupestris Ganzin 212.*

The following cuttings were received at Niles, March 22, 1904:

11415. *Pinot* × *Rupestris 1305.*

11416. *Rupestris Othello.*

11417. *Riparia* × *Rupestris-Aramon-Jaeger 201.*

11418. *Riparia* × *Berlandieri 161-49.*

11419. *Monticola* × *Riparia 18804.*

11420. *Chasselas* × *Rupestris 901.*

11421. *Columbaud* × *Riparia 2502.*

11422. *Riparia Grand Glabre* × *Aramon-Rupestris 4110.*

11423. *Rupestris* × *Riparia 1616.*

11424. *Pinot Bouschet* × *Riparia 3001.*

11425. *Rupestris* × *Petit Bouschet-Jaeger 504.*

11426. *Berlandieri* × *Riparia 34 E. M.*

11427. *Mourvedre* × *Rupestris 1202.*

11428. *Berlandieri* × *Riparia 33 E. M.*

11429. *Berlandieri* × *Riparia 420 A.*

11430. *Bourisquou* × *Rupestris 603.*

11431. *Berlandieri* × *Riparia 420 B.*

11432. *Riparia* × *Cordifolia-Rupestris 106-8.*

11433. *Tisserand.*

11434. *Riparia France.*

11435. *Monticola* × *Riparia 18815.*

11436. *Cabernet* × *Rupestris Ganzin 33 A.*

11437. *Riparia* × *Rupestris 3306.*

11438. *Riparia Martineau.*

11439. *Riparia* × *Rupestris Ramon.*

11440. *Rupestris Martin.*

11441. *Aramon* × *Riparia 143 A.*

11442. *Riparia* × *Rupestris 101-14.*

11443. *Rupestris* × *Berlandieri 301 A.*

11372 to 11477—Continued.

11444. *Carignane* × *Rupestris 504.*

11445. *Rupestris* × *Riparia 108-16.*

11446. *Rupestris de Semis 81-2.*

11447. *Aestivalis-Calicola* × *Riparia-Rupestris 554-5.*

11448. *Monticola* × *Riparia 18808.*

11449. *Aramon* × *Rupestris Ganzin 9.*

11450. *Berlandieri No. 2.*

11451. *Berlandieri* × *Riparia 157-11.*

11452. *Berlandieri Lafont No. 9.*

11453. *Riparia* × *Rupestris 101.*

11454. *Carignane* × *Rupestris 501.*

11455. *Rupestris* × *Berlandieri 301-37-152.*

11456. *Riparia* × *Rupestris 3309.*

11457. *Riparia* × *Rupestris de Jaeger.*

11458. *Viala* × *Riparia.*

11459. *Rupestris Mission.*

11460. (Unidentified.)

The following cuttings were received at Niles, April 11, 1904:

11461. *Bourisquou* × *Rupestris 109-4.*

11462. *Bourisquou* × *Rupestris 603.*

11463. *Carignane* × *Rupestris 504.*

11464. *Rupestris* × *Cordifolia 107-11.*

11465. *Rupestris* × *Hybrid Azemar 215.*

11466. *Alicante Bouschet* × *Cordifolia 142 B.*

11467. *Aestivalis-Rupestris* × *Riparia 227.*

11468. *Cordifolia* × *Rupestris.*

11469. *Rupestris* × *Berlandieri 301 B.*

11470. *Bourisquou* × *Rupestris 4306.*

11471. *Bourisquou* × *Rupestris 4308.*

11472. *Carignane* × *Rupestris 501.*

11473. *Calicola* × *Aestivalis 13205.*

11474. *York* × *Rupestris Ganzin.*

11475. (Unidentified.)

11476. *Cinerea-Rupestris* × *Riparia 229.*

11477. (Unidentified.)

11478. GARCINIA MORELLA. **Gamboge.**

From Castleton Gardens, Jamaica. Received July 18, 1904.

11479. LESPEDEZA STRIATA. **Japan clover.**

From Augusta, Ga. Received thru the N. L. Willet Drug Company, July 19, 1904.

11480. EUCHLAENA MEXICANA. **Teosinte.**

From Richmond, Va. Received thru T. W. Wood & Sons, July 20, 1904.

11481. Lolium perenne. **English rye-grass.**

From New York, N. Y. Received thru Henry Nungesser & Co., July 20, 1904.

11482. Festuca pratensis. **Meadow fescue.**

From New York, N. Y. Received thru Henry Nungesser & Co., July 20, 1904.

11483 and 11484.

From Ghent, Belgium. Received thru Mr. Louis Van Houtte, père, July 22, 1904.

11483. Garcinia livingstonei.

11484. Lansium sumatrana.

11485 to 11489. Phoenix dactylifera. **Date.**

From Fayum, Egypt. Received thru Mr. H. A. Rankin, July 26, 1904.

11485. *Saydy.*

11486. *Gaggar.*

11487. *Sultany.*

11488. *Frakhee.*

11489. *Saydy* (male)

"These date offshoots were wrapt in palm fiber (*lif*) and held in place by cords. They were rather dry, but in general in fairly good condition. Most of the offshoots were small, some not weighing over 10 pounds and only some half dozen weighing over 50 pounds. However, considering the inaccessibility of the region, we ought to be glad to get almost any kind of an offshoot that will grow. I noticed that the variety *Saydeh* has a large number of small offshoots attached to the sides of those sent, altho, as I stated above, the offshoots are only of medium size, averaging probably 30 to 40 pounds in weight. The collection of *Fraakhee* consisted of one very large offshoot and three very small ones. The very large offshoot showed a remarkable peculiarity in that the palm fiber, or '*lif*,' was still intact, forming a cardboard-like tissue, especially on the right-hand border. If this peculiarity of the interpetiolar sheets of fiber appears constant, this variety will have a very clear distinguishing mark." (*Swingle.*)

11490. Vitis rhombifolia. **Grape.**

Received from the United States Botanical Gardens, Washington, D. C., in 1901. Plants originally came from the Botanic Garden in Glasgow.

11491. Vitis gongylodes. **Grape.**

From St. Louis, Mo. Presented by Dr. William Trelease, superintendent of the Missouri Botanic Garden, to Dr. B. T. Galloway, in 1902.

11492. Vitis sp. **Grape.**

From Mexico. Received thru Dr. J. N. Rose, of the United States National Museum, in 1902. (Rose No. 286.)

11493. Vitis sp. **Grape.**

From Mexico. Received thru Dr. J. N. Rose, of the United States National Museum, in 1902. (Rose No. 749.)

11494. Phleum pratense. **Timothy.**

From Toledo, Ohio. Received thru W. D. Morehouse & Co., July 26, 1904.

11495. Panicum miliaceum. **Broom-corn millet.**

From Cincinnati, Ohio. Received thru J. M. McCullough's Sons, July 27, 1904.

11496. CHAETOCHLOA ITALICA. **German millet.**

From Chicago, Ill. Received thru the Albert Dickinson Company, July 27, 1904.

"Pellet" sample.

11497. NICOTIANA TABACUM. **Tobacco.**

From Cavala, Turkey. Presented by Mr. N. J. Pantelides, of Chios Island, Turkey. Received July 5, 1904.

"Seed of the famous Cavala tobacco, which forms one of the most important elements used in the blending of the cigarette filler of the famous Egyptian cigarettes. According to Mr. Pantelides's letter of June 18, 1904, this seed was sent him by the governor of Cavala and is no doubt authentic and of first quality. Mr. Pantelides further remarks that the cultivation and harvesting of the Cavala tobacco require great experience. From the same plant one can pick leaves of a value of only 0.50 of a franc per kilogram and of a value of 15 to 20 francs a kilogram. The lance-shaped leaves found at the summit of the plant have a very fine aroma, and it is for this fine aroma that such high prices are paid. If during the process of picking the terminal bud is injured, the fine aroma of the leaves is lost and the leaves lose their value. The processes of drying and fermentation are those which give to the leaves their fine color and excellent flavor. The Ottoman Regie pays from one to two thousand francs monthly salary to good clarifiers (clarificateurs) and 250 to 300 francs a month to good cultivators. In his country Mr. Pantelides says the seed is sown in January, transplanted during February to a place protected from the cold, and in March transplanted again to permanent locations. Each plant is set out a meter each way from its neighbors. The best soil for the culture of this tobacco is said to be a red one mixt with stones of iron pyrites, and the best locations are those on the eastern slopes of hills." (*Fairchild.*)

11498. NICOTIANA TABACUM. **Tobacco.**

From Sao Paulo, Brazil. Received thru Dr. Horace M. Lane, president of the Mackenzie College, July 25, 1904.

Bahiano tobacco seed, the variety from which the celebrated *Bahia* leaf is made.

11499. PRUNUS VIRGINIANA. **Chokecherry.**

"From Arden, near Dakota-Montana line. Presented by Prof. J. W. Blankinship, of the Montana Agricultural Experiment Station, Bozeman, Mont. Received August 1, 1904.

"Seeds of a free-flowering shrubby species of chokecherry which is perfectly hardy when the thermometer drops to −30° F. in winter. From the description given by Professor Blankinship this must be a very showy plant in spring. The black fruits are used for jam or 'cherry butter' making." (*Fairchild.*)

"A beautiful flowering tree, about 25 feet high." (*Blankinship.*)

11500. PRUNUS VIRGINIANA. **Chokecherry.**

From Bozeman, Mont. Presented by Prof. J. W. Blankinship. Received August 1, 1904.

"Seeds of a large, red-fruited variety, whose fruits are considered better than the black. Large quantities of cherry butter are made in Montana, and this variety has possibilities for the breeder." (*Fairchild.*)

11501. GARCINIA INDICA.

From Trinidad, West Indies. Received thru Mr. J. H. Hart, superintendent of the Botanic Gardens, July 29, 1904.

11502. GOSSYPIUM sp. **Cotton.**

From San Luis Soyatlan, Jalisco, Mexico. Received thru Señor Hilario Cuevas, July 21, 1904.

Cotton harvested in June from trees planted in September preceding at an altitude of 1,630 meters above the level of the sea. Sent at the request of Mr. L. H. Dewey.

11503. Mucuna utilis. **Velvet bean.**

From Clarcona, Fla. Received thru Mr. H. Meislahn, August 3, 1904.

11504. Coffea sp. **Coffee.**

From Abyssinia. Received thru Hon. Robert P. Skinner, United States consul-general at Marseille, France, July 22, 1904.

Wild *Harrar* coffee.

11505 to 11531.

From London, England. Received thru James Veitch & Sons (Limited), April, 1904.

A collection of plants, as follows:

11505. Rubus australis.

11506. Rubus biflorus.

11507. Rubus odoratus. **Purple flowering raspberry.**

11508. Rubus rosaefolius. **Strawberry raspberry.**

11509. Rubus phoenicolasius. **Wineberry.**

11510. Rubus nigrobaccus. **Blackberry.**
Snyder.

11511. Rubus spectabilis. **Salmon berry.**

11512. Rubus deliciosus. **Rocky Mountain flowering raspberry.**

11513. Rubus leucodermis. **Western black raspberry.**

11514. Rubus occidentalis. **Black raspberry.**
Newman's Thornless.

11515. Rubus nigrobaccus. **Blackberry.**

11516. Rubus hyb. **Raspberry-blackberry hyb.**
The Mahdi.

11517 and 11518. Rosa spp. **Rose.**

11517. *Alice Grahame.*
11518. *Bessie Brown.*

11519. Rosa humilis. **Pasture rose.**

11520 to 11531. Rosa spp. **Rose.**

11520. *Edith D'Ombrain.*
11521. *Florence Pemberton.*
11522. *Lady Moyra Beauclerc.*
11523. *Madame Antoine Mari.*
11524. *Marianne Pfitzer.*
11525. *Marie Lavälley.*
11526. *Mildred Grant.*
11527. *Morning Glow.*
11528. *Mrs. Allen Chandler.*
11529. *Mrs. Benjamin R. Cant.*
11530. *Queen of Sweden and Norway.*
11531. *Salmonea.*

11532. Arachis hypogaea. **Peanut.**

From Sao Paulo, Brazil. Received thru Dr. Horace M. Lane, president of the Mackenzie College, July 16, 1904.

Pods of a peanut, said to be native, but which Doctor Lane thinks may be of African origin. The pods are of fair size and nearly all contain two seeds.

11533. Polianthes longiflora. **Tuberose.**

From Mexico. Received thru Dr. J. N. Rose, of the United States National Museum, August 5, 1904.

11534. ACHRAS SAPOTA. **Sapodilla.**

Plants propagated from large tree in Department conservatory; numbered for convenience in recording future distribution, August 1, 1904.

11535. RICHARDIA AFRICANA. **Calla.**

From Chicago, Ill. Received thru Vaughan's seed store, August 10, 1904.

Trade name, *Calla Aethiopica devoniensis.*

11536 to 11538. ROSA sp. **Rose.**

From London, England. Received thru Barr & Sons, June, 1903.

11536. *Austrian Copper Brier.*

11537. *Harisoni Brier.*

11538. *Persian Yellow Brier.*

11539 to 11564.

From Feltham, Middlesex, England. Received thru Mr. Thomas S. Ware, Hale Farm Nurseries, August, 1903.

Plants, as follows:

11539 to 11563. CLEMATIS spp. **Clematis.**

11539. *Madame Édouard André.*

11540. *Grace Darling.*

11541. *Alexandra.*

11542. *Anderson Henryi.*

11543. *Ascontiensis.*

11544. *Beauty of Worcester.*

11545. *Duchess of Edinburgh.*

11546. *Duke of Edinburgh.*

11547. *Earl of Beaconsfield.*

11548. *Enchantress.*

11549. *Nellie Moser.*

11550. *Fairy Queen.*

11551. *Fair Rosamond.*

11552. CLEMATIS FORTUNEI.

11553. *Gem.*

11554. *Gipsey Queen.*

11555. *Gloire de St. Julien.*

11556. *Grand Duchess.*

11557. CLEMATIS RETICULATA.

11558. CLEMATIS JACKMANNI ALBA.

11559. CLEMATIS JACKMANNI.

Snow White.

11560. CLEMATIS JACKMANNI.

Superba.

11561. *John Gould.*

11562. *Lawsoniana.*

11563. *Marcel Moser.*

11564. AMPELOPSIS VEITCHII PURPUREA.

11565 to 11589. LILIUM spp. **Lily.**

From Yokohama, Japan. Received thru Suzuki & Iida, New York agents for the Yokohama Nursery Company, December, 1903.

Bulbs as follows:

11565. LILIUM BATMANNIAE.

11566. LILIUM CONCOLOR.

11567. LILIUM CONCOLOR OHIME.

11568. LILIUM CONCOLOR.

11569. LILIUM CONCOLOR OKIHIME.

11570. LILIUM CORDIFOLIUM.

11571. LILIUM ELEGANS.

11572. LILIUM ELEGANS.

11573. LILIUM ELEGANS ATROSANGUINEUM.

11574. LILIUM ELEGANS SEMIPLENO.

11565 to 11589—Continued.

11575. Lilium elegans incomparable.

11576. Lilium dahuricum.

11577. Lilium hansoni.

11578. Lilium japonicum.

11579. Lilium rubellum.

11580. Lilium brownii.

11581. Lilium leichtlinii.

11582. Lilium longiflorum.

11583. Lilium longiflorum eximium giganteum.

11584. Lilium medeoloides.

11585. Lilium speciosum rubrum.

11586. Lilium speciosum album.

11587. Lilium speciosum kretzeri.

11588. Lilium speciosum melpomene.

11589. Lilium ukeyuri.

11590 and 11591. Lilium longiflorum eximium giganteum. **Lily.**

Grown from S. P. I. No. 11583 in the Department greenhouse.

11590. Bulbs.

11591. Seeds.

11592 to 11602.

From Guadalajara, Mexico. Received thru Mr. Federico Chisolm, July 11, 1904.

Small lots of seeds of Guerrero plants, as follows:

11592. Enterolobium cyclocarpum. **"Parota."**

"One of the most admirable shade trees I have ever seen, a rapid grower, and valuable for the easily worked but durable lumber it yields, as well as for the seeds, which are largely eaten by the natives at this season and are greedily eaten by hogs. The measurements of a specimen shading the assay office at 'La Trinidad' were about as follows: Trunk, from ground to branches, 12 feet; diameter, 4 feet; from ground to top of tree, 59 feet; extreme spread of branches from tip to tip, measured thru trunk, 122 feet; the general outline similar to that of an umbrella. To me it seems a tree well worth introducing." (*Chisolm.*)

11593 to 11602.

A collection of unidentified plants, mostly bulbs.

11603 to 11623.

From Fort Hays, Kans. Received thru Mr. J. G. Haney, superintendent of the Branch Agricultural Experiment Station, August 1, 1904.

11603 to 11617. Triticum vulgare. **Wheat.**

11603. *Kharkof.* Grown from S. P. I. No. 7786.

11604. *Beloglina.* Grown from S. P. I. No. 7787.

11605. *Ulta.* Grown from S. P. I. No. 5638.

11606. *Crimean.* Grown from S. P. I. No. 5636.

11607. *Ghirka Winter.* Grown from S. P. I. No. 5637.

11608. *Padui.* Grown from S. P. I. No. 7466.

11609. *Kharkof.* Grown from S. P. I. No. 5641.

11610. *Turkey.* Grown from C. I. No. 1558.

11611. *Crimean.* Grown from S. P. I. No. 5635.

11612. *Crimean.* Grown from C. I. No. 1559.

11613. *Banat.* Grown from S. P. I. No. 5496.

11614. *Bacska.* Grown from S. P. I. No. 5498.

11615. *Weissenburg.* Grown from S. P. I. No. 5499.

11616. *Pesterboden.* Grown from S. P. I. No. 5500.

11617. *Kharkof.* Grown from S. P. I. No. 7467.

11603 to 11623—Continued.

11618 and 11619. TRITICUM DURUM. **Macaroni wheat.**

11618. *Kubanka.* Grown from S. P. I. No. 9478.

11619. *Velvet Don.* Grown from S. P. I. No. 9479.

11620 to 11623. HORDEUM spp. **Barley.**

11620. HORDEUM VULGARE. **Barley.**
Black. Grown from S. P. I. No. 7970.

11621. HORDEUM VULGARE. **Barley.**
White. Grown from S. P. I. No. 7969.

11622. HORDEUM DISTICHUM NUTANS. **Two-row barley.**
Hanna. Grown from S. P. I. No. 9133.

11623. HORDEUM TETRASTICHUM. **Four-row barley.**
Tetcherit. Grown from S. P. I. No. 7796.

11624. CERCIDIPHYLLUM JAPONICUM.

From Philadelphia, Pa. Received thru Thomas Meehan & Sons, 1903.

Plants purchased to test as stocks for the mango. The scions failed to unite.

11625. MANGIFERA INDICA. **Mango.**

From Tahiti. Received thru Captain Rennie, of the steamship *Mariposa*, August 11, 1904.

11626 and 11627. (Undetermined.)

From Guadalajara, Mexico. Received thru Mr. Federico Chisolm, August 13, 1904.

11628. HICORIA hyb. **Pecan.**

From Washington, D. C. Received thru Mr. P. H. Dorsett, February, 1904.

From pecans purchased in the open market. Has the appearance of a hybrid between *Hicoria pecan* and *Hicoria aquatica.* Planted in the Plant Introduction Garden at Chico, Cal., May 31, 1904.

11629. ACTINIDIA sp. **"Yang-taw."**

From the borders of Yunnan. Received thru Consul-General Wilcox, of Hankow, China, and Mr. Wilson, at the Plant Introduction Garden, Chico, Cal., July 8, 1904.

Fruit said to be very fine, has flavor of gooseberry, fig, and citron. Sometimes called "Yang-tao."

11630. ACTINIDIA sp. **"Yang-taw."**

From the borders of Yunnan. Received thru Consul-General Wilcox, of Hankow, China, and Mr. Wilson, at the Plant Introduction Garden, Chico, Cal., July 8, 1904.

Possibly distinct from No. 11629, tho as yet undetermined.

11631. ERIOBOTRYA JAPONICA. **Loquat.**

From Orange, Cal. Collected by Mr. M. Payan, of Olive, Cal., from the orchard of Mr. C. P. Taft, Orange, Cal. Received at the Plant Introduction Garden, Chico, Cal., July 18, 1904.

11632. ACHRAS SAPOTA (?). **Sapodilla.**

From Jalapa, Vera Cruz, Mexico. Received thru Mr. Frank N. Meyer at the Plant Introduction Garden at Chico, Cal., June, 1904.

"A nice tasting fruit, in size and shape not unlike the eastern persimmon. The pulp is brownish and of a sweet, pleasant taste." (*Meyer.*)

11633. PRUNUS ARMENIACA. **Apricot.**

From Jalapa, Vera Cruz, Mexico. Received thru Mr. Frank N. Meyer at the Plant Introduction Garden at Chico, Cal., June, 1904.

"These apricots are small in size but have sometimes a nice flavor. They seem to be all seedlings and vary, it is said, a great deal." (*Meyer.*)

11634. CICER ARIETINUM. **Chick-pea.**

From Jalapa, Vera Cruz, Mexico. Received thru Mr. Frank N. Meyer at the Plant Introduction Garden at Chico, Cal., June, 1904.

"A vegetable which is eaten like green peas. On some markets they are sold roasted in the shell, and they taste well. Grown on dry but rich lands." (*Meyer.*)

11635. FRAXINUS sp. **Ash.**

From Mexico. Received thru Mr. Frank N. Meyer at the Plant Introduction Garden at Chico, Cal., June, 1904.

"A very handsome shade tree, which grows to quite a size. These seeds are from a very spreading variety which grew on dry, rocky places near Guadalajara." (*Meyer.*)

11636. PRUNUS sp. **Cherry.**

From Jalapa, Vera Cruz, Mexico. Received thru Mr. Frank N. Meyer at the Plant Introduction Garden at Chico, Cal., June, 1904.

"This is a cherry inferior in size and flavor to the ordinary cherry. The tree is evergreen and can be used as an ornamental shade tree." (*Meyer.*)

11637. LUPINUS sp. **Lupine.**

From Jalapa, Vera Cruz, Mexico. Received thru Mr. Frank N. Meyer at the Plant Introduction Garden at Chico, Cal., June, 1904.

"A rather ornamental small lupine, with blue spikes, which vary in color from whitish to indigo blue." (*Meyer.*)

11638. RICINUS sp. **Castor-oil plant.**

From Jalapa, Vera Cruz, Mexico. Received thru Mr. Frank N. Meyer at the Plant Introduction Garden at Chico, Cal., June, 1904.

"A castor-oil bean with very showy red spikes. May prove to be an ornamental plant." (*Meyer.*)

11639. CAPSICUM ANNUUM. **Pepper.**

From Jalapa, Vera Cruz, Mexico. Received thru Mr. Frank N. Meyer at the Plant Introduction Garden at Chico, Cal., June, 1904.

Yellow Chili. "A handsome pepper, much sold in the market at Jalapa, a bright showy yellow, quite pungent in taste." (*Meyer.*)

11640. AGROSTIS ALBA. **Redtop.**

From New York, N. Y. Received thru Henry Nungesser & Co., August 16, 1904.

11641 to 11644.

From Nice, Alpes-Maritimes, France. Received thru Dr. A. Robertson-Proschowsky, August 1, 1904.

11641. ARUNDINARIA SIMONI. **Bamboo.**

"A small bamboo, producing good, edible seeds. This small bamboo does not, as some others, die altogether after producing its seeds, but some rhizomes survive. Still perhaps it is too early to judge of the survival of such. As you will find, the large seeds are of very good taste, and evidently could be used

11641 to 11644—Continued.

as well as wheat, barley, and other grains. This bamboo is very resistant to drought. Would it eventually be a plant of any other than ornamental use? Perhaps some of your active and enterprising correspondents in the United States would care to try this plant." (*Proschowsky.*)

11642. JACARANDA OVALIFOLIA.

"The well-known tree of most striking beauty of foliage and flower. The timber is very strong. Resists well in dry places." (*Proschowsky.*)

11643. ALOË DICHOTOMA.

"Forms a picturesque tree of medicinal value." (*Proschowsky.*)

11644. PITTOSPORUM MACROPHYLLUM.

"This is a tree of very regular growth and striking beauty. Its leaves are nearly as large as those of *Magnolia grandiflora* L. But its chief merit consists in its beautiful creamy-white flowers, which exhale a perfume surpassing that of any other plant I know, even the orange and lemon. I should think that the extraction of this perfume would prove a paying undertaking." (*Proschowsky.*)

11645 and 11646. MANGIFERA spp.

From Saigon, Cochin China. Received thru Mr. M. E. Haffner, director of agriculture, August 20, 1904.

Seeds as follows:

11645. MANGIFERA CAMBODIANA.

11646. MANGIFERA MEKONGENSIS.

11647. MUSA sp. **Banana.**

From Monte, Grand Canary. Received thru Mr. Alaricus Delmard, August 22, 1904.

11648. MAMMEA AMERICANA. **Mammee apple.**

From Mayaguez, P. R. Received thru Mr. O. W. Barrett, Agricultural Experiment Station, August 22, 1904.

For use in mangosteen experiments.

11649. LILIUM NEILGHERRENSE. **Neilgherry lily.**

From Utakamand, India. Received thru Mr. G. H. Cave, superintendent of the Government Botanic Gardens, August 19, 1904.

11650. TRITICUM DICOCCUM. **Emmer.**

From Paris, France. Received thru Vilmorin-Andrieux & Co., August 27, 1904.

Amidonnier noir.

11651 and 11652. MEDICAGO SATIVA. **Alfalfa.**

From City of Mexico, Mexico. Received thru Mr. Felix Foëx, National School of Agriculture, August 24, 1904.

11651. *Atlixco*, from State of Pueblo.

11652. *Apater*, from State of Guanajuato.

11653. CALOPHYLLUM CALABA.

From Honolulu, Hawaii. Received thru Mr. Gerrit P. Wilder, August 29, 1904.

For experiments in propagating the mangosteen.

11654. LANDOLPHIA sp. (?).

From Africa. Presented thru Mr. G. N. Collins by Mr. Gilbert Christy. Received August 31, 1904.

11655. AVENA SATIVA. **Oat.**

From Statesville, N. C. Received thru Dr. B. W. Kilgore, of the North Carolina Agricultural Experiment Station, September 2, 1904.

11656. THEOBROMA CACAO. **Cacao.**

From Nicoya, Costa Rica. Received thru Mr. G. N. Collins, June, 1903. (G. & G. No. 3979.)

11657. CASTILLOA NICOYENSIS. **Central American rubber.**

From Nicoya, Costa Rica. Received thru Mr. G. N. Collins, June, 1903. (G. & G. No. 3980.)

11658. HORDEUM VULGARE. **Barley.**

From Blacksburg, Va. Received thru Mr. John R. Fain, September 7, 1904.

Tennessee Winter barley, shipped from Jefferson City, Tenn.

11659. THEVETIA OVATA (?).

From Guadalajara, Mexico. Received from Mr. Federico Chisolm, September 3, 1904.

11660. HELIANTHUS sp. **Sunflower.**

From Bozeman, Mont. Received from the Montana Agricultural Experiment Station, August 29, 1904.

11661 to 11673. CITRUS DECUMANA. **Pomelo.**

From Calcutta, India. Originally from Mr. David Prain, of the Royal Botanic Garden. Presented to the Department by Mr. Henry Phipps, 6 East Eighty-seventh street, New York, N. Y. Received September 8, 1904.

Plants as follows:

11661. "Large White-Fleshed," from Seharunpur.

11662. "Large Red-Fleshed," from Seharunpur.

11663. "China," from Seharunpur.

11664. "Pure White Sweet," from Bangalore.

11665. "White Sweet," from Bangalore.

11666. "Red Sweet Variety," from Bangalore.

11667. "White Sour," from Bangalore.

11668. "Large," from Lucknow.

11669. "Small," from Lucknow.

11670. "White," from the Agricultural-Horticultural Society, Alipore, Calcutta, India.

11671. "A. H. Society's," from the Agricultural-Horticultural Society, Alipore, Calcutta, India.

11672. "Pink," from the Agricultural-Horticultural Society, Alipore, Calcutta, India.

11673. "Royal Botanic Garden" variety, from Calcutta.

11674. VITIS COIGNETIAE. **Crimson glory vine.**

From New York, N. Y. Received thru Messrs. Henry & Lee, 97 Water street, September 9, 1904.

11675. ANANAS SATIVUS. **Pineapple.**

Received September 9, 1904. (Mailed from some point in Liberia, but origin unknown.)

11676. BALSAMORRHIZA sp. **Balsam root.**

From Bozeman, Mont. Received thru Mr. A. J. Pieters, August, 1904.

11677. VICIA SATIVA. **Common vetch.**

From New York, N. Y. Received thru J. M. Thorburn & Co., 36 Cortlandt street, September, 1904.

11678. HORDEUM VULGARE. **Barley.**

From St. Anthony Park, Minn. Received thru Prof. W. M. Hays, of the Agricultural Experiment Station, September, 1904.

11679. VICIA SATIVA. **Common vetch.**

From Richmond, Va. Received thru T. W. Wood & Sons, September, 1904.

11680. VICIA VILLOSA. **Hairy vetch.**

From Richmond, Va. Received thru T. W. Wood & Sons, September, 1904.

11681. BRUCEA SUMATRANA. **"Kosam."**

From Singapore, Straits Settlements. Received from the Botanic Gardens, thru the German consulate, September 12, 1904.

The fruit of this plant is said to be an infallible remedy for dysentery.

11682. LIPPIA REPENS.

From Santa Barbara, Cal. Received thru Dr. F. Franceschi at the Plant Introduction Garden, Chico, Cal., August 26, 1904.

"Thrives in any soil, no matter how poor. Rapidly covers the ground with a very dense matting. Takes one-tenth as much water as any lawn; needs no mowing; will stand intense heat and several degrees of cold. Can be established in sloping ground." (*Franceschi.*) (See S. P. I. No. 4263.)

11683. HUMULUS LUPULUS. **Hop.**

From Wheatland, Cal. Received at the Plant Introduction Garden, Chico, Cal., August 15, 1904.

11684. BRASSICA NAPUS. **Rape.**

From New York, N. Y. Received thru Henry Nungesser & Co., September 15, 1904.

Dwarf Essex.

11685 to 11696.

From Guadalajara, Mexico. Received thru Mr. Federico Chisolm, September 19, 1904.

Miscellaneous seeds and bulbs, mostly unidentified.

11697. VICIA FABA. **Horse bean.**

From Ottawa, Canada. Received thru Graham Brothers, September 21, 1904.

Tick.

11698 to 11713. MANIHOT spp. **Cassava.**

From Sao Paulo, Brazil. Received thru Prof. Alberto Löfgren, director of the Botanic Gardens, September 24, 1904.

11698 to 11713 – Continued.

Cuttings, as follows:

11698. *Globo.*
11699. *Vermelha do Pinhal.*
11700. *Boucava Brava.* (Poisonous.)
11701. *Tatu.*
11702. *Aipim Amarello.*
11703. *Vermelha.*
11704. *Branca.*
11705. *Mata Fome.*
11706. *Barra Bonita.*
11707. *Aipim Doce.*
11708. *Amarella.*
11709. *Cambalho Brava.*
11710. *Mata Fome II.*
11711. *Rosa.*
11712. *Sao Tedrinho.* (Very poisonous.)
11713. *Itapira Brava.* (Poisonous.)

11714. TRITICUM VULGARE. **Wheat.**

From Tempe, Ariz. Received thru Mr. John Jungerman, September 26, 1904.

Fretes. Grown from S. P. I. No. 7582.

11715. TRITICUM DURUM. **Macaroni wheat.**

From Tempe, Ariz. Received thru Mr. John Jungerman, September 26, 1904.

Marouani. Grown from S. P. I. No. 9324.

11716 and 11717. HORDEUM TETRASTICHUM. **Four-row barley.**

From Tempe, Ariz. Received thru Mr. John Jungerman, September 26, 1904.

11716. *Beldi.* Grown from S. P. I. No. 7583.
11717. *Telli.* Grown from S. P. I. No. 7584.

11718 and 11719. LIATRIS SCARIOSA. **Button snakeroot.**

From Minneapolis, Minn. Presented by Prof. E. M. Freeman. Received September 22, 1904.

11718. Roots or corms.
11719. Seed.

11720. SICANA ODORIFERA.

From Trinidad, British West Indies. Presented by Mr. J. H. Hart, superintendent of the Royal Botanic Gardens. Received September 20, 1904.

11721. GARCINIA CELEBICA.

From Buitenzorg, Java, Dutch East Indies. Presented by Doctor Treub, September 28, 1904.

11722. AVENA SATIVA. **Oat.**

From Yancey, Ga. Purchased from Mr. H. Yancey, jr. Received September 28, 1904.

Appler Rustproof.

11723. IPOMOEA PES-CAPRAE.

From Durban, Natal. Presented by Mr. J. L. Elmore, agent and importer of American goods, Third avenue. Received September 30, 1904.

"These small seeds and pods grow here on the sand next to the seashore, and greatly retard the sand from blowing inland. They grow on runners as much as 30 feet in length, every few feet throwing up stems with large green leaves a foot above the sand, thus preventing the sand from shifting." (*Elmore.*)

11724. PERSEA GRATISSIMA. **Avocado.**

From Durban, Natal. Presented by Mr. J. L. Elmore. Received September 30, 1904, in same package with No. 11723.

"These pears have only been introduced into this country for a few years, and are proving a source of great revenue. The trees are strong and healthy, and bear after about five years' growth—grow as well from seeds as grafted ones. When in season prices range here for the fruit from 50 cents to $2 per dozen. The fruit never ripens on the tree, but soon ripens after it is full grown and picked and laid aside for a few days. This fruit can be transported any distance, as it is perfectly hard when pulled and does not soften for some days. After being laid aside for a few days they become soft and then are edible. The flesh is about one-half inch in thickness, and when ripe of a light yellow shading to a pea green next to the skin, and if eaten with a little sugar and milk is like rich cream. Some prefer salt and pepper and a little vinegar; others nothing at all. I know of people here who eat no meat when these pears are in season. The trees grow in a sandy soil to a good size, and I think they would grow in the Southern States and California." (*Elmore.*)

11725. GARCINIA MANGOSTANA. **Mangosteen.**

From Saigon, Cochin China. Presented by Dr. M. E. Haffner, director of the Botanic Gardens. Received October 3, 1904.

11726. PSIDIUM GUAJAVA. **Guava.**

From Trinidad, British West Indies. Presented by Mr. J. H. Hart, superintendent of the Royal Botanic Gardens. Received October 3, 1904.

A large red guava. Fruit of this variety is reputed to weigh at the rate of three to a pound. (*Hart.*)

11727. PANICUM DECOMPOSITUM. **Australian millet.**

From Sydney, New South Wales. Presented by Mr. J. H. Maiden, director of the Botanic Gardens. Received October 4, 1904.

"From the dry interior of southwestern Queensland. The seed was collected by the blacks, who use it largely for food, while the grass itself is one of the best fodder grasses of Australia." (*Maiden.*) (See Maiden's *Useful Native Plants of Australia*, p. 97.)

11728 to 11730. LILIUM LONGIFLORUM EXIMEUM. **Easter lily.**

From New York, N. Y. Received thru Henry & Lee, August 3, 1904.

11728. Bermuda-grown bulbs.

11729. Azores-grown bulbs.

11730. Japan-grown bulbs.

11731. TRITICUM sp. **Wheat.**

From Germany. Presented by Mr. A. Kirsche, Pfiffelbach, near Apolda, thru Mr. J. E. W. Tracy. Received September 30, 1904.

Original *Winter Square Head.*

11732. GARCINIA MANGOSTANA. **Mangosteen.**

From Singapore, Straits Settlements. Presented by Mr. R. Derry, assistant superintendent of the Botanic Gardens. Received November 18, 1904.

11733. ASPARAGUS VIRGATUS. **Asparagus.**

From Durban, Natal, South Africa. Presented by Mr. J. Medley Wood, curator of the Botanic Gardens. Received November 18, 1904.

"A native Natal asparagus, which is said to produce edible shoots of good quality. The plant does not require so much care as the cultivated asparagus, and may therefore prove of value for breeding purposes." (*Wood.*)

11734. Carissa arduina. **Amatungulu.**

From Natal, South Africa. Presented by Mr. J. Medley Wood, curator of the Botanic Gardens, Durban. Received August 8, 1904.

"A food plant of considerable importance in Natal, where it is found in large quantities on the market, and from which is made a very valuable jelly. The plant, grown in hedge form in and about the city of Durban, is a handsome thing; its large white flowers and crimson fruits stand out in beautiful contrast with the background of dark-green foliage." (*Fairchild.*)

11735. Secale cereale. **Rye.**

From Steglitz, near Berlin, Germany. Received thru Metz & Co., October 6, 1904.

Original *Professor Heinrich.*

11736. Eucalyptus corynocalyx. **Sugar gum tree.**

From Pomona, Cal. Received thru Mr. G. W. Kuesthardt, November 11, 1904.

11737. Poa pratensis. **Kentucky bluegrass.**

From New York, N. Y. Received thru J. M. Thorburn & Co., October 10, 1904.

11738. Vicia sativa. **Common vetch.**

From New York, N. Y. Received thru J. M. Thorburn & Co., October 10, 1904.

11739. Thysanolaena agrostis.

From Sibpur, near Calcutta, India. Presented by the Royal Botanic Garden. Received August 3, 1904.

See S. P. I. No. 8445 for a description of this extremely ornamental flowering cane.

11740. Pentzia virgata.

From Oatlands, South Africa. Received thru Messrs. Lathrop and Fairchild (No. 1138, March, 1903), August 1, 1904. (See No. 10635.)

11741 and 11742. Capsicum annuum. **Paprika pepper.**

From Bridgeport, Ala. Grown by the Botanic Drug Company. Received August 29, 1904.

11741. *Szeged Rose*, grown from S. P. I. No. 10755.

11742. Large, red, long *Hungarian*, grown from S. P. I. No. 10756.

11743 to 11757.

From Melbourne, Australia. Presented by Mr. William Robert Guilfoyle, director of the Botanic Gardens. Received July, 1904.

Sample packets of seed as follows:

11743. Acacia longifolia.
11744. Acacia prominens.
11745. Carpodetus serratus.
11746. Eutelea arborescens.
11747. Eucalyptus botryoides.
11748. Eucalyptus longifolia.
11749. Grevillea robusta.
11750. Hymenosporum flavum.
11751. Panax elegans.
11752. Pittosporum buchanani.
11753. Pittosporum undulatum.
11754. Sterculia acerifolia.
11755. Sterculia diversifolia.
11756. Syncarpia laurifolia.
11757. Tristania laurina.

11758. ULEX EUROPAEUS. **Gorse, whin, or furze.**

From Dublin, Ireland. Presented by Hogg & Robertson, seedsmen. Received in June, 1904.

"This plant is used extensively in northern France, England, and Ireland as a fodder plant. It is not cultivated there, however. Shredders are used for preparing it for stock, and, according to Mr. J. B. Blandy, of Funchal, Madeira, who uses it extensively, it is a most valuable plant for barren soils where other things will not grow." (*Fairchild.*)

11759. VICIA FABA. **Horse bean.**

From Montreal, Canada. Received thru Prof. W. T. Macoum, horticulturist, Central Experiment Farm, Ottawa, Canada, from William Ewing & Co., October 12, 1904.

11760. SECALE CEREALE. **Rye.**

From Waterloo, Kans. Received thru Mr. J. Elza Dodge, October 14, 1904.

Grown from S. P. I. No. 1342.

11761 and 11762. ALLIUM CEPA. **Onion.**

From Teneriffe, Canary Islands. Presented by United States Consul Solomon Berliner. Received October 6, 1904.

11761. *White.* **11762.** *Red.*

11763. VICIA VILLOSA. **Hairy vetch.**

From Augusta, Ga. Received thru the N. L. Willet Drug Company, October 15, 1904.

11764. VICIA SATIVA. **Common vetch.**

From New York, N. Y. Received thru J. M. Thorburn & Co., October 19, 1904.

11765. PERSEA CAROLINENSIS. **Red bay, or swamp bay.**

From New Orleans, La. Presented by Mr. Edward Baker, superintendent of Audubon Park. Received October 17, 1904.

"In regions where the avocado (*Persea gratissima*) can be grown, but which are subject at long intervals to heavy, killing frosts, this relative of the latter may prove valuable as a stock on which to graft it. It may also be of use for breeding purposes." (*Fairchild.*)

11766 to 11768.

From Honolulu, Hawaii. Presented by Mr. Gerrit P. Wilder. Received October 14, 1904.

Specimen fruits as follows:

11766. MANGIFERA INDICA. **Mango.**

"Very fine specimen, grown on the premises of Mr. W. C. Parke, of Honolulu. Considered one of our best mangos here." (*Wilder.*)

11767. (Unidentified.) **11768.** (Unidentified.)

11769. CEDRELA ODORATA.

From Buenos Aires, Argentine Republic. Presented by Mr. Carlos Thays, director of the Jardin Botanico. Received October 22, 1904.

"This plant belongs to a group of trees which Dr. F. Franceschi, of Santa Barbara, Cal., has been studying for some time. He remarks in a letter of September 20, 1903, as follows: 'The Cedrela I consider among the most interesting of the trees which I have tried here, and remarkably so *C. fissilis*, which makes a wonderful growth and appears to be much hardier than its native habitat would warrant.' The use of the timber of this species of Cedrela for cigar boxes makes the plants of unusual interest to southern California, where they will grow unusually well." (*Fairchild.*)

11770. GAILLARDIA sp. **Gaillardia.**

From Big Stone City, S. Dak. Collected by Mr. A. J. Pieters, August, 1904.

"Sample of seed of a Gaillardia with rose-purple rays. Low-growing perennial (?). Flowers borne on peduncle arising from the base of the plant, and usually from a foot to 18 inches high. May be a good thing for crossing with other Gaillardias, but not a sufficiently profuse bloomer by itself." (*Pieters.*)

11771. CHRYSOPSIS HISPIDA. **Golden aster.**

From Dawson, N. Dak. Collected by Mr. A. J. Pieters, August, 1904.

"Found blooming at Dawson, N. Dak., and thruout that country during late August, 1904. Calyx scales glutinous, flowers yellow." (*Pieters.*)

11772. LIATRIS sp. **Button snakeroot.**

From near Fargo, N. Dak. Collected by Mr. A. J. Pieters, August, 1904.

"Seed of a fine perennial for the herbaceous border. Grows 2 to 3 feet high and bears a fine spike with purple flowers." (*Pieters.*)

11773. HELIANTHUS sp. **Sunflower.**

From Dawson, N. Dak. Collected by Mr. A. J. Pieters, August, 1904.

"Practically the same type as that known in the trade as *Stella.* Varies in size from 12 inches to 4 feet or more, depending on soil and moisture." (*Pieters.*)

11774. CUCUMIS sp. **Melon.**

From province of Esmeraldas, Ecuador. Presented by Mr. George D. Hedian. Received September 20, 1904.

"Fruit grows to a size of 48 to 50 cm. in length; yellow when ripe, and pulp resembles that of muskmelon. Has fragrant odor when ripening." (*Hedian.*)

11775. GOSSYPIUM sp. **Cotton.**

From province of Esmeraldas, Ecuador. Presented by Mr. George D. Hedian. Received September 20, 1904.

11776. GOSSYPIUM sp. **Cotton.**

From province of Esmeraldas, Ecuador. Presented by Mr. George D. Hedian. Received September 20, 1904.

This cotton seed in bolls grows 8 feet high and buds in six months.

11777. AMYGDALUS PERSICA. **Nectarine.**

From Kashgar, Kashmir, British India. Presented by Rev. P. J. P. Hendriks. Received October 24, 1904.

"Collected in the latter part of July by Mr. Hendriks at Kashgar and forwarded by parcel post. Mr. Hendriks remarks in his letter of July 23 that 'they want a hot but only a short summer, and as walnuts are ripening in Washington I am confident that they will come all right. You may call them *Crosby* nectarines. I am quite sure they will make a fine acquisition to any orchard.'

"In compliance with the wish of the donor, if these nectarines prove in any way remarkable they should be named in honor of Mr. O. T. Crosby, to whom we are indebted for putting us in communication with Mr. Hendriks." (*Fairchild.*)

11778. PISTACIA VERA. **Pistache.**

From Kashgar, Kashmir, British India. Presented by Rev. P. J. P. Hendriks. Received October 24, 1904.

"These seeds were collected by Mr. Hendriks from the bazaar in Kashgar. He is afraid they will have lost their germinative power, but as they come from the hot valleys of Badakhshan, west of the Pamirs, they may prove a different strain from those introduced from the Levant and to be of unusual value. These were received by parcels post thru Latham & Co., of Bombay, India. Larger shipments must be sent by caravan from Kashgar to Ladak, thence by caravan to Kashmir, thence to Rawlpindi and by rail to Bombay. The costs of transit would be about 2 rupees per kilogram and the time required about two months." (*Fairchild.*)

11779. MANGIFERA INDICA. **Mango.**

From Beira, East Africa. Presented by Hon. Arthur W. H. Glenny, United States consular agent, Beira, East Africa.

Lathrop. See description of No. 9669.

11780. HORDEUM VULGARE. **Barley.**

From McPherson, Kans. Received thru Mr. L. A. Fitz, October 25, 1904.

Tennessee Winter.

11781. SESBANIA MACROCARPA.

From Tucson, Ariz. Received thru Prof. R. H. Forbes, director of the Agricultural Experiment Station, October 25, 1904.

"I am convinced from its very shallow root system that it will probably only prove useful in a situation where it can be constantly and abundantly irrigated, altho it is possible that its rooting habits may be modified by new cultural conditions." (*Forbes.*)

11782. TRIFOLIUM ALEXANDRINUM. **Berseem.**

From Cairo, Egypt. Received thru Mr. George P. Foaden, secretary of the Khedivial Agricultural Society, October 26, 1904.

Fachl.

11783. NUPHAR POLYSEPALUM. **Red-anthered yellow water lily.**

From Bozeman, Mont. Presented by Dr. J. W. Blankinship. Received October 27, 1904.

"An unusual species of pond lily, with red anthers somewhat resembling large petals. As this has never, so far as we are aware, been brought under cultivation, it is thought by Mr. Peter Bisset, of "Twin Oaks," Washington, D. C., to be of possible value for breeding purposes. Coming from the northern latitude of Montana, it will prove perfectly hardy in any part of the United States." (*Fairchild.*)

11784. GARCINIA XANTHOCHYMUS.

From Peradeniya, Ceylon. Presented by Dr. John C. Willis, director of the Royal Botanic Gardens. Received October 29, 1904.

11785 to 11790. GARCINIA spp.

From Peradeniya, Ceylon. Received thru Dr. John C. Willis, director of the Royal Botanic Gardens, October 31, 1904.

11785. G. CAMBOGIA=G. COWA.
11786. G. MANGOSTANA.
11787. G. CAMBOGIA=G. COWA.
11788. G. XANTHOCHYMUS.
11789. G. SPICATA.
11790. G. MORELLA.

11791. VICIA SATIVA. **Common vetch.**

From Corvallis, Oreg. Received thru Mr. John Whitaker, October 31, 1904.

11792. Caesalpinia brevifolia. **Algarobillo.**

From Santiago, Chile. Presented by Señor Salvadore Izquierdo. Received September 19, 1904.

The tanning material, which exists in the form of a resinous substance permeating the seed pods of this plant, has recently attracted the serious attention of European tanners, and the imports of it into Germany have of recent years very considerably increased. It is said to be very quick in its action and to be used in the tanning of delicate leathers. American tanners are not familiar with this tanning substance as yet, but some of the principal importers in New York are interested in its introduction. The shrub which bears the pods should be of particular interest to the extremely arid regions of the Southwestern States from the fact that it comes from the high altitudes of the Andes of northern Chile, where the season's rainfall is extremely light and where long periods of hot, dry weather occur. The plant has a long taproot, which will make it difficult to transplant, and it is recommended by Señor Izquierdo that the seeds be planted out where the plants are expected to remain. According to Señor Izquierdo's estimate, 2,000 plants could be easily grown on an acre of soil. Trees 6 to 8 years old are said to yield from 6 to 8 pounds of pods, which sell at a price ranging from 4 to 6 cents a pound. It is said that the plant is injured by heavy spring frosts, but is otherwise a robust, vigorous growing species. (See S. P. I., 10631.)

11793. Andropogon sorghum. **Sorghum.**

From Durban, Natal, South Africa. Presented by Mr. R. W. Beningfield. Received August 24, 1904.

Mr. Beningfield says that this sorghum was self-sown in his garden in Durban.

11794. Lilium longiflorum multiflorum. **Japanese lily.**

From New York, N. Y. Received thru Henry & Lee, November 9, 1904.

11795. Sapium sebiferum. **Tallow tree.**

From China. Presented by Dr. C. L. Marlatt to Dr. B. T. Galloway. Planted in October, 1903.

Chinese name "Sa-men."

11796. Cucumis melo. **Muskmelon.**

From California. Received in 1902. Exact source is not known.

Genuine *Bidwell Casaba* muskmelon seed, turned over to this Office by Mr. W. W. Tracy, sr.

11797. Macadamia ternifolia. **Australian nut.**

From Sydney, New South Wales. Presented by Mr. J. H. Maiden, director of the Botanic Gardens. Received November 5, 1904.

11798. Papaver somniferum × bracteatum. **Hybrid poppy.**

From Santa Rosa, Cal. Presented by Mr. Luther Burbank. Received November 7, 1904.

11799. Thevetia cuneifolia. **Trumpet flower.**

From Guadalajara, Mexico. Presented by Mr. Federico Chisolm. Received November 7, 1904.

11800. Panicum maximum. **Guinea grass.**

From Mayaguez, P. R. Received thru Mr. O. W. Barrett, of the Agricultural Experiment Station, November 8, 1904.

"Tho it produces viable seeds, this famous grass is usually propagated by division of the root clumps." (*Barrett.*)

11801 to 11996. PHOENIX DACTYLIFERA. **Date.**

From Hofhuf, El-Hasa, Turkish Arabia. Received thru Rev. S. M. Zwemer and secured by Mr. J. Calcott Gaskin, of the British Assistant Political Agency, Bahrein Island, Persian Gulf, November 7, 1904.

According to Mr. Gaskin's letter, the following varieties were received: *Khalas*, *Rezeiz*, *Shebibi*, *Khir*, *Hatmi*, *Sheishi*, *Mehmi*, *Kheneizi*, *Tenâjil*, and *Mejnaz*. These names, however, did not agree with those found on the labels accompanying the plants, which were placed there by the Arabs and most of which were lost. In order to avoid confusion each sucker was given a separate number in hopes that they might be correctly identified from descriptions of these varieties when they come into bearing.

11997. SEQUOIA WELLINGTONIA. **Bigtree.**

Origin unknown.

11998. VICIA FABA. **Horse bean.**

From Gembloux, Belgium. Received thru Dr. Ach. Grégoire, Institut Chimique et Bactériologique de l'État, March 10, 1905.

"Seed of the Holland variety of horse bean grown extensively in Belgium and Holland as a fodder crop. This bean in the cool summers of northern Europe makes a growth of several feet and produces a succulent fodder which is harvested after the beans have ripened, and run thru a chopping machine which prepares it for the stock. The analyses of Doctor Grégoire have shown that there is a material increase in the amount of nutritious substances in this bean late in the season, making it advisable to cut it only after the beans have fully matured. The small size of the bean of this Dutch variety makes it especially desirable for field experiments where the item of seed transport is an important one.

"These should be tried extensively in Alaska and the Northwestern States as an early summer crop. They are likely also to be of value as a cover crop for orchards in the Northern States. Experiments in Canada have proved this horse bean to be the best cover crop yet tried in that region. It holds snow, prevents drifting, and adds a large amount of humus to the soil. In Belgium these beans are drilled in about 6 or 8 inches apart and produce a thick stand some 3 or 4 feet in height." (*Fairchild.*)

11999 and 12000. NICOTIANA TABACUM. **Tobacco.**

From Constantinople, Turkey. Received thru Mr. Charles M. Dickinson, United States consul-general, March 9, 1905.

Seed from Xanthi district, as follows:

11999. Finest quality.
12000. Medium quality.

12001 to 12018.

From Fort Hays, Kans. Received thru Mr. J. G. Haney, superintendent of the Branch Experiment Station, November 7, 1904.

12001 to 12015. TRITICUM VULGARE. **Wheat.**

12001. *Kharkof.* Grown from S. P. I. No. 7786. C. I. No. 2193.
12002. *Beloglino.* Grown from S. P. I. No. 7787. C. I. No. 1667.
12003. *Crimean.* Grown from S. P. I. No. 5636. C. I. No. 1437.
12004. *Theiss.* Grown from S. P. I. No. 5497. C. I. No. 1561.
12005. *Ulta.* Grown from S. P. I. No. 5638. C. I. No. 1439.
12006. *Ghirka.* Grown from S. P. I. No. 5637. C. I. No. 1438.
12007. *Crimean.* Grown from S. P. I. No. 5635. C. I. No. 1436.
12008. *Kharkof.* Grown from S. P. I. No. 7467. C. I. No. 1583.
12009. *Kharkof.* Grown from S. P. I. No. 5641. C. I. No. 1442.

12001 to 12018—Continued.

12010. *Crimean.*

Grown from seed originally imported in quantity of over 14,000 bushels from the Crimea in 1901 by the millers of Kansas and Oklahoma. C. I. No. 1559.

12011. *Banat.* Grown from S. P. I. No. 5496. C. I. No. 1560.

12012. *Bacska.* Grown from S. P. I. No. 5498. C. I. No. 1562.

12013. *Turkey.* Grown from C. I. No. 1558.

The best grade of this variety was grown near Halstead, Kans., from seed originally from the Crimea. A sample was planted in the experiment plats at Halstead in the autumn of 1901 for future experiment.

12014. *Weissenberg.* Grown from S. P. I. No. 5499. C. I. No. 1563.

12015. *Pesterboden.* Grown from S. P. I. No. 5500. C. I. No. 1563.

12016 to 12018. PANICUM MILIACEUM. **Broom-corn millet.**

12016. *Red Voronezh.* Grown from S. P. I. No. 9424. Original seed from Russia.

12017. *Black Voronezh.* Grown from S. P. I. No. 9425. Original seed from Russia.

12018. *Red Orenburg.* Grown from S. P. I. No. 9423. Original seed from Russia.

12019. GARCINIA XANTHOCHYMUS.

From Honolulu, Hawaii. Presented by Mr. G. P. Wilder. Received October 31, 1904.

"Fruits from a tree growing in the Government nursery of Honolulu. Sent for identification. This species is promising as a stock upon which to graft the mangosteen. Its fruits have an agreeable acid flavor." (*Fairchild.*)

12020. PORTULACARIA AFRA. **Spek-boom.**

From Durban, Natal. Received thru Messrs. Lathrop and Fairchild (No. 1097, February 8, 1903), November 9, 1904.

"A native South African shrub or small tree with succulent shoots which, according to von Müller, has been tested for many years in Australia, and which Mr. John M. Wood, of the Durban Botanic Garden, says has been sent to Algeria for experimental purposes. The shoots are said to be keenly relished by live stock, and the plant is reported to grow on dry, waste places without requiring attention. The cuttings take root easily, and von Müller says that the plant may even be propagated from the leaves. The range of this species is not known by the writer, but it will probably thrive only in a frostless region. The plant grows on hot, rocky slopes, preferably of doleritic nature. Plant on stony ridges or in sandy, desert soil. This species deserves to be given a wide distribution in regions where it will grow wild, and should be called to the attention of those interested in the cattle-range question of Arizona and Hawaii. These cuttings were donated by Mr. Wood." (*Fairchild.*)

12021. GARCINIA COCHINCHINENSIS.

From Durban, Natal. Received thru Messrs. Lathrop and Fairchild (No. 1102, February 8, 1903), November 9, 1904.

"This tree is a more vigorous one and easier to adapt to cultivation than *G. mangostana*, the true mangosteen. It is also a heavier bearer, and it is valuable in connection with experiments on the cultivation of the mangosteen in Porto Rico and Hawaii. The fruit is a golden-yellow color, one-seeded, with characteristic acid-flavored pulp. Most people do not care for the taste of this fruit, but the writer found the fruits most refreshing, and Mr. Wood, of the Botanic Gardens in Durban, who kindly donated the seeds, says that a former governor of Natal was very fond of them. Trees of this species should be raised in gardens in Florida, Porto Rico, and Hawaii accessible for breeding and grafting experiments. It may prove a good stock for the mangosteen." (*Fairchild.*)

12022. GARCINIA MANGOSTANA. **Mangosteen.**

From Singapore, Straits Settlements. Presented by Mr. R. Derry, assistant superintendent of the Botanic Gardens. Received November 9, 1904.

12023. HORDEUM DISTICHUM. **Two-row barley.**

From Fresno, Cal. Received thru Mr. George C. Roeding, December 22, 1904.

White Smyrna. Grown from S. P. I. No. 7969.

12024 and 12025. SECHIUM EDULE. **Chayote.**

From Saltillo, Mexico. Presented by Mr. J. R. Silliman at the request of Dr. Edward Palmer. Received November 7, 1904.

"An unusually large and fine variety of the chayote, representing two doubtful subvarieties, the one a darker green in color than the other and considered a sweeter sort. This is considered one of the best, and is indeed one of the most commonly grown vegetables in Mexico and Central America. The particularly large size of these varieties makes them promising for introduction into the warmer regions of this country. Bulletin No. 28 of the Bureau of Plant Industry gives a full description of the methods of planting, etc." (*Fairchild.*)

12026 and 12027. ZEA MAYS. **Corn.**

From Saltillo, Mexico. Presented by Mr. J. R. Silliman. Received November 7, 1904.

12026. Genuine white *Mexican June.*

12027. Genuine red *Mexican June.*

"I am sending you four ears of genuine *Mexican June* corn grown by myself. This corn was planted in June and harvested about the 15th of October. The natives mix their seed very much and are not at all careful with it, so a great deal of the so-called *Mexican June* corn is not strictly such. Of the white variety there are two classes—one with white cob, the other with red cob. The grains are long and thin, the cob very small. It is a great drought resister and very sweet, the Mexican children chewing the stalks as they do sugar cane. Cattle are very fond of the green stalk and it produces a fine flow of rich milk in cows. The stalk reaches a height of 8 to 12 feet and is very slender; therefore we plant it quite thick. The dark variety, or *Maíz pinto*, is considered more hardy and better for resisting dry weather. It is shorter and more stocky in its growth. It is not so sweet. It will give a crop when all else fails. While not considered so fine for general use, it is equal to any for all stock." (*Silliman.*)

12028 to 12103. PAEONIA spp. **Peony.**

From Langport, Somerset, England. Received thru Messrs. Kelway & Son, November 12, 1904.

Peonies imported for testing on the grounds of the Department of Agriculture at Arlington, Va., 76 varieties, as follows:

12028. *Maria Kelway.*
12029. *Agnes Mary Kelway.*
12030. *Lady Curzon.*
12031. *Princess Beatrice.*
12032. *Mrs. Chamberlain.*
12033. *Mountebank.*
12034. *Festiva Maxima.*
12035. *Princess Irene.*
12036. *Duke of Clarence.*
12037. *Lady Beresford.*
12038. *Limosel.*
12039. *Paderewski.*
12040. *Mad Calot.*
12041. *Torquemada.*
12042. *Glory of Somerset.*
12043. *Prince of Wales.*
12044. *Leonard Kelway.*
12045. *Dorothy Welsh.*
12046. *Alonzo.*
12047. *Grizzel Muir.*
12048. *Solfaterre.*
12049. *Lottie Collins.*

12028 to 12103—Continued.

12050. *Kelway's Queen.*
12051. *Helena.*
12052. *Joan Seaton.*
12053. *Princess Christian.*
12054. *Princess of Wales.*
12055. *Lady Gwendolen Cecil.*
12056. *Mrs. Asquith.*
12057. *Stanley.*
12058. *Prince George.*
12059. *Cognita.*
12060. *Duchess of Teck.*
12061. *Autumnus.*
12062. *Humei White.*
12063. *Summer Day.*
12064. *Moonbeam.*
12065. *Reine des Français.*
12066. *Whitleyi Plena.*
12067. *Prince Prosper.*
12068. *Lady Carrington.*
12069. *Sir T. J. Lipton.*
12070. *Princess May.*
12071. *Queen Victoria.*
12072. *Miss Salway.*
12073. *Bunch of Perfume.*
12074. *Millais.*
12075. *Tinted Venus.*
12076. *Miss Brice.*
12077. *Nominata.*
12078. *Calliphon.*
12079. *Duke of Devonshire.*
12080. *Baroness Schroeder.*
12081. *The Bride.*
12082. *Ella Christine Kelway.*
12083. *Cyclops.*
12084. *Sainfoin.*
12085. *Venus.*
12086. *Duchess of Sutherland.*
12087. *Mr. Manning.*
12088. *Queen of the May.*
12089. *Lady Cecilia Rose.*
12090. *Viscount Cross.*
12091. *Lyde.*
12092. *Water Lily.*
12093. *Princess Dhuleep Singh.*
12094. *Cendrillon.*
12095. *Alton Locke.*
12096. *Argus.*
12097. *Hesperus.*
12098. *Amiable.*
12099. *Lady Bramwell.*
12100. *Cavalleria Rusticana.*
12101. *Emily.*
12102. *Clothos.*
12103. *Opiter.*

12104. FREYCINETIA ARBOREA.

From Honolulu, Hawaii. Received thru Mr. J. E. Higgins, horticulturist, Agricultural Experiment Station, November 14, 1904.

12105 to 12107. NICOTIANA TABACUM. **Tobacco.**

From Brazil. Presented by Mr. M. Caluron, secretary of Agriculture, Railways, Industry, and Public Works of the State of Bahia. Received October 31, 1904.

12105. From Santa Anna.
12106. From Maragogipe.
12107. From S. Gonçalo dos Campos.

12108. CUCUMIS MELO. **Muskmelon.**

From Bairam Ali, Old Merv, Turkestan. Presented by Prof. R. W. Pumpelly. Received November 12, 1904.

12109. CUCUMIS MELO. **Muskmelon.**

From Samarkand, Turkestan. Presented by Prof. R. W. Pumpelly. Received November 12, 1904.

12110. CALOPHYLLUM INOPHYLLUM.

From Honolulu, Hawaii. Received thru Mr. Gerrit P. Wilder, November 15, 1904.

"Imported for use as a possible stock on which to graft the mangosteen, *Garcinia mangostana*." (*Fairchild.*)

12111 and 12112.

From Nice, Alpes-Maritimes, France. Presented by Dr. A. Robertson-Proschowsky. Received November 14, 1904.

12111. FICUS GLOMERATA. **Cluster fig.**

12112. OPUNTIA FICUS INDICA. **Prickly pear.**

12113. SOLANUM COMMERSONI. **Aquatic potato.**

From Santa Rosa, Cal. Presented by Mr. Luther Burbank. Received November 18, 1904.

"Tubers produced from plants grown in Mr. Burbank's experimental grounds from imported tubers, S. P. I. No. 10324. First generation removed from importation." (*Fairchild.*)

12114. JUGLANS REGIA. **Persian walnut.**

From Khojend, Russian Central Asia. Received thru Mr. E. Valneff, November 15, 1904.

12115. SECHIUM EDULE. **Chayote.**

From Mexico. Received thru Dr. Edward Palmer, November 21, 1904.

12116 to 12119. HORDEUM spp. **Barley.**

From Milwaukee, Wis. Presented by Mr. G. G. Pabst, president of the Pabst Brewing Company. Received November 9, 1904.

Four samples of barley grown from seed furnished by this Department, originally purchased in Svalöf, Sweden, from the General Swedish Seed-Breeding Institute, as follows:

12116. HORDEUM DISTICHUM NUTANS.

Prinsess. Grown from S. P. I. No. 10583 on the Summer farm, Wauwatosa, Wis. Yielded 13 bushels from 1 peck of seed.

12117. HORDEUM DISTICHUM NUTANS.

Chevalier II. Grown from S. P. I. No. 10584 on the Wasson farm, Granville, Wis. Yielded 5½ bushels from 1 peck, approximately.

12118. HORDEUM DISTICHUM NUTANS.

Hannchen. Grown from S. P. I. No. 10585 on the Wasson farm, Granville, Wis. Yielded 7 bushels from 1 peck of seed.

12119. HORDEUM DISTICHUM ERECTUM.

Primus. Grown from S. P. I. No. 10586 on the farm of Mr. John Schubert, Granville, Wis. Yielded 4 bushels from 1 peck of seed.

12120 to 12129. HORDEUM spp. **Barley.**

From Milwaukee, Wis. Presented by Mr. August Uihlein, secretary of the Schlitz Brewing Company. Received November 21, 1904.

Barley samples, as follows:

12120. HORDEUM TETRASTICHUM.

Albacete. Grown from S. P. I. No. 7427, originally from Spain.

12120 to 12129—Continued.

12121. HORDEUM DISTICHUM.

Grown from S. P. I. No. 7992, originally from Munich, Bavaria.

12122. HORDEUM HEXASTICHUM.

Grown from S. P. I. No. 8559, originally from Christiania, Norway.

12123. HORDEUM VULGARE.

Maraout. Grown from S. P. I. No. 9877, originally from Cairo, Egypt.

12124. HORDEUM sp.

Grown from California seed that was originally imported from Moravia.

12125. HORDEUM DISTICHUM NUTANS.

Hanna. Grown from S. P. I. No. 10402, originally from Austria.

12126. HORDEUM DISTICHUM NUTANS.

Prinsess. Grown from S. P. I. No. 10583, originally from Sweden.

12127. HORDEUM DISTICHUM NUTANS.

Chevalier II. Grown from S. P. I. No. 10584, originally from Sweden.

12128. HORDEUM DISTICHUM NUTANS.

Hannchen. Grown from S. P. I. No. 10585, originally from Sweden.

12129. HORDEUM DISTICHUM ERECTUM.

Primus. Grown from S. P. I. No. 10586, originally from Sweden.

12130. ORYZA SATIVA. **Rice.**

From Calcutta, India. Received thru I. Henry Burkill, esq., M. C., officiating reporter on economic products to the government of India, Indian Museum, October 21, 1904.

Rekikesh paddy seed, said to be the most valuable rice in India; grown on the Ganges where it emerges from the hills. A lowland variety of rice, said to be worth twenty times the price of ordinary rice.

12131. XANTHOXYLUM PIPERITUM. **Japanese pepper.**

From Yokohama, Japan. Received thru the Yokohama Nursery Company, November 14, 1904.

12132 to 12134.

From Brighton, Utah. Received thru Mr. Ephraim Clawson, November 10, 1904.

12132. TRIFOLIUM ALEXANDRINUM. **Berseem.**

12133. AVENA SATIVA. **Oat.**

Grown from S. P. I. No. 10269, originally from Algeria.

12134. TRITICUM VULGARE. **Wheat.**

Chul-bidai. Grown from S. P. I. No. 9131, originally from Russia.

12135. VICIA ATROPURPUREA.

From Santa Clara, Cal. Received thru Mr. C. C. Morse in 1904.

12136 and 12137.

From London, England. Received thru Messrs. James Veitch & Sons (Limited), Chelsea, S. W., November 25, 1904.

12136. EUCOMMIA ULMOIDES. **Tu-chung.**

"*Tu-chung* is the name given by the Chinese to the tree which has been described by Professor Oliver in Hooker's Icones Plantarum as *Eucommia*

12136 and 12137—Continued.

ulmoides. The bark is the only part used, and is much esteemed by the Chinese as a drug, tonic and various other properties being assigned to it. It is described in nearly all Chinese works on materia medica and botany, the earliest mention of it being given in the Herbal of which the Emperor Shên-Nung is the reputed author, and which was committed to writing probably as early as the first century of our era.

"The tree is cultivated in small plantations in the mountainous regions of Szechwan, Hupeh, and Shensi; and from these districts it is brought to Hankow, the great mart for drugs that are produced in the western provinces. From this port about 100 tons are annually exported by steamer to the other treaty ports.

"*Eucommia ulmoides* has been grown out of doors at Kew without any protection for the last six years. It is a vigorous, free-rooting plant, and bears transplanting well. It will, I believe, thrive in any soil of average quality, but seems to prefer a rich, light loam. In such a soil, at Kew, young trees struck from cuttings five years ago are now 6 feet high and make shoots 2 feet to 2½ feet long in one season.

"It can be propagated easily by means of cuttings, and with these two methods may be adopted. The quickest method is to take pieces of the current season's growth, about 6 inches long, in late July or early August, insert them in pots of very sandy soil (the usual mixture for cuttings), and then place the pots in a house or frame where slight bottom heat can be afforded. The cuttings should be made of shoots in what gardeners term a "half-woody" condition. They will take root in a few weeks and can then, after a "hardening-off" period, be planted in nursery beds. The second method is to make the cuttings of the leafless wood in November and dibble them in sandy soil in a cool frame or out of doors under a *cloche*, or hand light. They will take root the following spring. This method is not so quick as the other, nor have we found it so sure." (*Kew Bulletin No. 1, 1904.*)

12137. DAVIDIA INVOLUCRATA. **Davidia.**

(See description of this beautiful tree under S. P. I. No. 16208.)

12138. MANGIFERA INDICA. Mango.

From Miami, Fla. Received thru P. H. Rolfs, November 23, 1904.

Gordon. Grown from S. P. I. No. 3705.

12139. NICOTIANA SANDERAE. Flowering tobacco.

From Philadelphia, Pa. Received thru Henry A. Dreer, Incorporated, November 25, 1904.

Carmine tuberose-flowered. Seed of a new hybrid Nicotiana raised in England. Described as forming bushy, much-branched plants 2 feet high, laden with flowers from base to summit. Flowers are a carmine red and fragrant, a single plant producing thousands. Resembles *N. affinis* in form, but has a short, stout tube and does not close up in daytime. (See No. 12358 for history.)

12140 to 12230.

From Yokohama, Japan. Received thru the Yokohama Nursery Company at the Plant Introduction Garden, Chico, Cal., October 31, 1904.

12140. ARALIA CORDATA. **Moyashi udo.**

Two-year-old roots.

12141. CITRUS sp. **Orange.**

Natsudaidai.

12142. EDGEWORTHIA GARDNERI. **Mitsumata paper plant.**

12143 to 12155. LILIUM spp. **Lily.**

12143. LILIUM ALEXANDRAE.

12144. LILIUM AURATUM.

12145. LILIUM BATMANNIAE.

12146. LILIUM BROWNII.

12140 to 12230—Continued.

12143 to 12155—Continued.

12147. Lilium cordifolium.
12148. Lilium concolor.
12149. Lilium hansoni.
12150. Lilium krameri.
12151. Lilium leichtlini.
12152. Lilium longiflorum.
12153. Lilium medeoloides.
12154. Lilium speciosum album.
12155. Lilium tigrinum.

12156. Miscanthus condensatus.

12157 to 12176. Nelumbium speciosum. **Lotus.**

12157. *Tenjiku ren.*
12158. *Tenjiku madara.*
12159. *Hichiyo ren.*
12160. *Taihaku ren.*
12161. *Toka ren.*
12162. *Higo shibori.*
12163. *Shokko ren.*
12164. *Tama usagi.*
12165. *Shiro manman.*
12166. *Nikko ren.*
12167. *Giozan ren.*
12168. *Kayo ren.*
12169. *Haku botan.*
12170. *Sakura ren.*
12171. *Usuyo ren.*
12172. *Seihaku ren.*
12173. *Shosho ren.*
12174. *Beni botan.*
12175. *Kinshi ren.*
12176. *Asahi ren.*

12177. Phyllostachys henonis. **Bamboo.**
12178. Phyllostachys mitis. **Bamboo.**
12179. Phyllostachys nigra. **Bamboo.**
12180. Phyllostachys quilioi. **Bamboo.**

12181 to 12230. Prunus pseudo-cerasus. **Flowering cherry.**

12181. *Koshioyama.*
12182. *Yaye hizakura.*
12183. *Oshokun.*
12184. *Haru arashi.*
12185. *Haria sau.*
12186. *Kurama yama.*
12187. *Higau shidare.*
12188. *Oshibayama.*
12189. *Beni gamo.*
12190. *Kongasau.*
12191. *Shira taye.*
12192. *Batan zakura.*
12193. *Strogetsu.*
12194. *Aki irosakura.*
12195. *Ben den.*
12196. *Asagi sakura.*
12197. *Kumagai sakura.*
12198. *Nara* (?) *sakura.*
12199. *Kirigaya.*
12200. *Kafugen.*
12201. *Benihigan.*
12202. *Washi-no-O.*
12203. *Kiuriuji.*
12204. *Onaden.*
12205. *Ichiyo.*
12206. *Gigo.*
12207. *Meigetsu.*
12208. *Jouioi.*
12209. *Hizakura* (single).
12210. *Mikuruma gaishi.*
12211. *Hosokawa nioi.*
12212. *Horinji.*
12213. *Hata sakura.*
12214. *Ochochin.*
12215. *Yokihi.*
12216. *Shiogama sakura.*
12217. *Toyama sakura.*
12218. *Kokishinuden.*

12140 to 12230—Continued.

12181 to 12230—Continued.

12219. *Nikoromoki.*
12220. *Hakukezan.*
12221. *Gozanoma nioi.*
12222. *Kikushidase.*
12223. *Taki nioi.*
12224. *Heto maru.*
12225. *Senreko.*
12226. *Totankisahura.*
12227. *Amanó gawa.*
12228. *Fugenzo.*
12229. *Ouchizakura.*
12230. *Kiriu.*

12231. MEDICAGO SATIVA. **Alfalfa.**

From Vernon, Tex. Received thru Mr. J. A. White, November 28, 1904.

Turkestan. Grown from S. P. I. No. 9450.

12232. PISTACIA TEREBINTHUS. **Terebinth.**

From Paris, France. Received thru Vilmorin-Andrieux & Co., November 23, 1904.

12233. HYACINTHUS ORIENTALIS ALBULUS. **Hyacinth.**

From New York, N. Y. Received thru J. M. Thorburn & Co., November 26, 1904.

12234. PHLEUM PRATENSE. **Timothy.**

From Tunis, Tunis. Presented by Prof. R. Gagey, of the Agricultural College. Received November 30, 1904.

12235. LILIUM PHILIPPINENSE. **Benguet lily.**

From Manila, P. I. Presented by Mr. Elmer D. Merrill. Received November 15, 1904. Collected by Mr. R. S. Williams, collector for the New York Botanical Gardens in the province of Benguet, P. I.

12236 and 12237.

From Clearbrook, Whatcom County, Wash. Presented by Mr. George Gibbs. Received December 2, 1904.

12236. ACER MACROPHYLLUM. **Oregon maple.**

"Handsome, roundheaded tree, remarkable for its large foliage. Not hardy in the North. In western Washington these maples grow from 2 to 5 feet the first year from seed. They are the finest of street shade trees, and stand any amount of wind. They grow 60 feet high at Clearbrook and reach 3 to 6 feet in diameter." (*Gibbs.*)

12237. THUJA GIGANTEA. **Giant arbor vitae.**

12238. LANSIUM DOMESTICUM. **Doekoe.**

From Buitenzorg, Java. Presented by Doctor Treub. Received December 5, 1904.

"One of the most refreshing fruits of the Dutch East Indies, which deserves to be well known in the Western Tropics, but which hitherto seems to have been quite overlooked." (*Fairchild.*)

"A low-growing tree of the East Indies which is cultivated to some extent for its fruit, which is known in Java and Malakka as 'Lanseh' fruit and is much esteemed for its delicate aroma. The pulp is of somewhat firm consistence and contains a cooling, refreshing juice." (*Jackson in Trans. Linn. Soc., XIV, 1 (1823), 115.*)

12239. AGAPANTHUS UMBELLATUS.

From Washington, D. C. Received thru the National Botanic Garden in 1902.

12240. MANGIFERA INDICA. **Mango.**

From Manatee, Fla. Received thru Mr. A. J. Pettigrew, December 7, 1904.

Peters No. 1. Grown from S. P. I. No. 3706.

12241. MANGIFERA INDICA. **Mango.**

From Mangonia, Fla. Presented by Rev. E. E. Gale. Received December 7, 1904.

Père Louis. Grown from S. P. I. No. 3707.

12242. BERBERIS FREMONTII.

From Tucson, Ariz. Received thru Mr. D. G. Fairchild at the Plant Introduction Garden, Chico, Cal., September 10, 1904.

"Seeds from plants growing on the experiment station grounds. A beautiful desert form for breeding with *B. thunbergii.*" (*Fairchild.*)

12243. PISTACIA VERA. **Pistache.**

From northern Syria. Received thru Mr. W. T. Swingle at the Plant Introduction Garden, Chico, Cal., October 6, 1904.

"These seeds were grown from trees grafted on *P. mutica* and were obtained from a Mr. Nazar, whose people graft the pistache on this species in the dry country near the Euphrates River." (*Swingle.*)

12244 to 12302.

A collection of bulbs secured for experimental work in the Department bulb garden.

12244 to 12265.

From Hillegom, Haarlem, Holland. Received thru Vander Schoot & Son, October, 1903.

12266 to 12276.

From London, England. Received thru William Bull & Sons, November, 1903.

12277 to 12279.

From Clearbrook, Wash. Received thru Mr. George Gibbs, November, 1904.

12280 to 12298.

From Guernsey, England. Received from Hubert & Co., September, 1904. Purchased thru Mr. Nicholas Le Page, Mount Vernon, N. Y.

12299 to 12302.

From Ettrick, Va. Received thru Poat Brothers, October, 1904.

12303. AVENA SATIVA. **Oat.**

From Brookings, S. Dak. Received thru Mr. H. I. Stearns, December 8, 1904.

Sixty-Day. Grown from S. P. I. No. 5938.

12304. SECHIUM EDULE. **Chayote.**

From New Orleans, La. Presented by the J. Steckler Seed Company. Received November 23, 1904.

12305. MANGIFERA INDICA. **Mango.**

From West Palm Beach, Fla. Received thru Mr. John B. Beach, December 9, 1904.

Mulgoba.

12306. Gossypium sp. **Cotton.**

From the Philippine Islands. Presented by Dr. B. D. Halsted, Agricultural Experiment Station, New Brunswick, N. J. Received December 6, 1904.

Kaki. These seeds were collected by Mr. A. Ellicott Brown, of the Marine Corps, and sent to Doctor Halsted.

12307 to 12357. Salix spp. **Willow.**

From Ottawa, Canada. Presented by Dr. William Saunders, director of the Central Experimental Farm. Received December 14, 1902.

A collection of species and varieties of willow growing in the arboretum of the Central Experimental Farm at Ottawa. The nomenclature given is that recognized by the Experimental Farm.

12307. Salix caesia pendula zabeli.
12308. Salix nigricans prunifolia.
12309. Salix daphnoides pomerania femina.
12310. Salix triandra (S. lappeana).
12311. Salix purpurea scharfenbergensis.
12312. Salix casiandra lancifolia.
12313. Salix fragilis basfordiana.
12314. Salix rubra forbyana.
12315. Salix argentea aurita.
12316. Salix nigricans moabitica.
12317. Salix bataviae.
12318. Salix alba britzensis.
12319. Salix nigricans cotinifolia.
12320. Salix alba vitellina.
12321. Salix daphnoides femina.
12322. Salix petiolaris.
12323. Salix seringeana.
12324. Salix alba vitellina.
12325. Salix erdingeri.
12326. Salix nigricans ansoniana.
12327. Salix purpurea urabensis.
12328. Salix undulata.
12329. Salix viminalis.
12330. Salix daphnoides mascula.
12331. Salix blanda (S. babylonica × fragilis).
12332. Salix bicolor laureana.
12333. Salix decipiens.
12334. Salix alba vitellina aurantiaca.
12335. Salix purpurea lambertiana.
12336. Salix cinerea tricolor.
12337. Salix ambigua.
12338. Salix voronesh.
12339. Salix smithiana acuminata (S. dasyclados).
12340. Salix pellita.
12341. Salix repens argentea.
12342. Salix longifolia.
12343. Salix laurina.
12344. Salix babylonica.
12345. Salix cinerea repens.
12346. Salix fragilis ammaniana.
12347. Salix alba argentea.
12348. Salix nigricans menthaefolia.
12349. Salix rosmarinifolia.
12350. Salix nigricans.
12351. Salix mollissima.
12352. Salix viminalis superba.
12353. Salix hippophaefolia undulata.
12354. Salix spaethii.
12355. Salix cordata vestita.
12356. Salix alba vitellina nova.
12357. Salix nigricans viburnoides.

12358. NICOTIANA SANDERAE. **Flowering tobacco.**

From New York, N. Y. Received thru J. M. Thorburn & Co., December 14, 1904.

Carmine-flowered. "This variety is the result of crossing the dwarf purple-flowered *N. forgetiana*, from Brazil, with *N. affinis*, the well-known, fragrant white-flowered garden annual." (*Sander & Sons.*)

12359. LATHYRUS ODORATUS. **Sweet pea.**

From Covent Garden, W. C., London, England. Received thru Watkins & Simpson, 12 Tavistock street, December 9, 1904.

Gladys Unwin.

12360. AFZELIA QUANZENSIS.

From Cape Town, Cape Colony, Africa. Received thru Dr. Peter MacOwan, government botanist, November 28, 1904.

12361. LATHYRUS SYLVESTRIS. **Flat pea.**

From New York, N. Y. Received thru J. M. Thorburn & Co., November 21, 1904.

12362 and 12363.

From Bangkok, Siam. Presented by His Excellency Phya Akharaj Varadhara, the Siamese minister, to Dr. B. T. Galloway. Received December 2, 1904.

Plants used extensively in Bangkok as a condiment.

12362.

Krawan.

12363.

(No name given.)

12364. LILIUM GIGANTEUM. **Lily.**

From New York, N. Y. Received thru Henry & Lee, December 13, 1904.

12365. PANICUM MAXIMUM. **Guinea grass.**

From Mayaguez, P. R. Received thru the Agricultural Experiment Station, December 21, 1904.

12366. SECHIUM EDULE. **Chayote.**

From New Orleans, La. Received thru the J. Steckler Seed Company, December 16, 1904.

12367. DAHLIA sp. **Dahlia.**

From "La Trinidad," Guerrero, Mexico. Received thru Mr. Federico Chisolm, December 13, 1904.

12368. GLADIOLUS GANDAVENSIS. **Gladiolus.**

From Philadelphia, Pa. Received thru Henry A. Dreer, Incorporated, December 16, 1904.

White Lady.

12369. PACHYRHIZUS sp.

From Santa Maria del Rio, Mexico. Received thru Dr. Edward Palmer, December 21, 1904.

"There are two forms of this Pachyrhizus, one called *Agua* (water) and the other *Leche* (milk). These two forms have been long recognized, but not as separate species. At Santa Maria del Rio I saw several fields of this plant cultivated on ridges so that the plants might be irrigated. I was informed that both forms were grown in the same patch and could not be distinguished either by their foliage or flowers, and that it was only by tasting the roots themselves that the difference could be detected. Both varieties are considered equally valuable. They are eaten raw, especially by travelers on long tours thru the drier portions of the country, as their watery character makes them valuable for quenching one's thirst. They are also considered nutritious and are said to make good pickles. It is possible that they may also be cooked as turnips are and could be cultivated in regions where the turnip will not thrive." (*Palmer.*)

12370. Iris sp. **Iris.**

From Fairfield, Wash. Collected by Mr. A. J. Pieters, August 21, 1904.

12371 to 12393. **Abyssinian seeds.**

From Abyssinia, Africa. Received thru Hon. Robert P. Skinner, commissioner of the United States to Abyssinia, December 15, 1904.

A collection of seeds made for Mr. Skinner under his direction by Mr. Eugène Carette Bouvet. This collection is supplementary to the collection received June 3, 1904, Nos. 11039 to 11119, from the same source. The names given are transcribed from those written upon the original packages.

12371.	Andropogon sorghum.	**Sorghum.**
12372.	Andropogon sorghum.	**Sorghum.**
12373.	Andropogon sorghum.	**Sorghum.**
12374.	Andropogon sorghum.	**Sorghum.**
12375.	Hordeum sp.	**Barley.**
12376.	Hordeum sp.	**Barley.**
12377.	Triticum sp.	**Wheat.**
12378.	Eragrostis abyssinica.	**Teff.**
12379.	Triticum dicoccum.	**Emmer.**
12380.	Coffea sp.	**Wild coffee.**
12381.	Coffea sp.	**Harrar coffee.**
12382.	Coffea sp.	**Cultivated coffee.**
12383.	Zea mays.	**Corn.**
12384.	Zea mays.	**Corn.**
12385.	Eragrostis abyssinica.	**Teff.**
12386.	Eragrostis abyssinica.	**Teff.**
12387.	Sesamum indicum.	**Sesame.**
12388.	Pimpinella anisum.	**Anise.**
12389.	Guizotia oleifera.	
12390.	Eleusine coracana.	
12391.	Linum sp.	**Flax.**
12392.	Pisum sativum.	**Pea.**
12393.	Cicer arietinum.	**Chick-pea.**

12394. Beta vulgaris. **Sugar beet.**

From New York, N. Y. Received thru Mr. Albert Bohm, Wool Exchange Building, West Broadway and Beach streets, December 21, 1904.

Said by Mr. Bohm to be more subject to outside influences than ordinary seed.

12395. Physalis sp. **Ground cherry.**

From Columbus, Ohio. Received thru the Livingston Seed Company, December 23, 1904.

Ordered for Mr. Burbank's experiments.

12396. PHYSALIS sp. **Purple ground cherry.**

From Columbus, Ohio. Received thru the Livingston Seed Company, December 24, 1904.

12397. ZINNIA ELEGANS. **Zinnia.**

From Naples, Italy. Received thru Mr. Max Herb, successor to Herb & Wulle, 24–36 via Trivio, December 24, 1904.

Zinnia elegans, fl. pl. crispa, extra; described in volume 19 of Möller's Deutsche Gärtner-Zeitung, p. 475.

12398. MEDICAGO SATIVA. **Alfalfa.**

From Fort Collins, Colo. Received thru Mr. Peter Anderson, December 28, 1904.

12399 and 12400. GLYCINE HISPIDA. **Soy bean.**

From Amherst, Mass. Received thru the Hatch Experiment Station, December 28, 1904.

12399. Grown from S. P. I. No. 9407.

12400. Grown from S. P. I. No. 9408.

12401. IPOMOEA sp.

From Miami, Fla. Received thru Prof. P. H. Rolfs, Subtropical Laboratory, December 23, 1904.

A pink-flowered Ipomœa grown from seed secured by Professor Rolfs in Cuba or Jamaica.

12402 and 12403. OPUNTIA FICUS-INDICA GYMNOCARPA. **Tuna.**

From Nice, France. Received thru Dr. A. Robertson-Proschowsky, December 27, 1904.

"In a letter of December 12, Doctor Proschowsky remarks: 'The young joints of this species have small spines, but these fall off in the second year. As regards the fruits, it is three years that they have been produced in my garden, and they have always been absolutely spineless without any of those almost microscopic spicules which are the great objection to the fruits of Opuntia in general.' The present year only three fruits were developed, and the seeds sent, No. 12403, are from one of those fruits. As this small number of seeds represents the total number contained in the fruit it is evident that the variety, in addition to bearing spineless fruits, bears fruits with comparatively few seeds in them. Doctor Proschowsky further remarks that this Opuntia is the largest, quickest growing, and most picturesque of all of the Opuntias which he has ever seen." (*Fairchild.*)

12404. CEREUS VALIDUS.

From Nice, France. Received thru Dr. A. Robertson-Proschowsky, December 27, 1904.

"A tall, picturesque plant, which produces fruit the size of a goose egg and of a beautiful magenta color. These fruits are absolutely without spicules and of very good taste. Doctor Proschowsky remarks that he knows of no other fruit which is so 'melting,' and it resembles much the 'snows' sold in Latin-American countries, consisting of real snow mixed with some fruit juice or sugar." (*Fairchild.*)

12405 to 12407.

From New York, N. Y. Received thru J. M. Thorburn & Co., December 28, 1904.

12405. HOLCUS LANATUS. **Velvet grass.**

A forage grass of poor quality, but capable of growing well on dry soil.

12405 to 12407—Continued.

12406. Spergula arvensis. **Spurry.**

An annual plant of especial value on dry, sandy land.

12407. Ornithopus sativus. **Serradella.**

An annual legume for growing on dry, sandy land.

12408. Ulex europaeus. **Gorse, whin, or furze.**

From Dublin, Ireland. Received thru Hogg & Robertson, December 29, 1904.

"The cultivation of this plant is suited only to waste lands which are unfit for more profitable cultures. In portions of northern France, the Netherlands, England, and Ireland the plant is utilized successfully as fodder, being cut and passed thru a special shredding machine, which reduces the spines to a harmless pulp. In the Madeira Islands, J. B. Blandy informed me that it was very keenly relished by cattle and furnished an excellent fodder for milk-producing purposes. The plant, altho not a tender species, will probably not be hardy in the Northwest, but should be tried in regions with a climate similar to that of England and Ireland, on rocky, barren hillsides where other plants will not thrive." (*Fairchild.*)

12409. Medicago sativa. **Alfalfa.**

From Ogden, Utah. Received thru the C. A. Smurthwaite Produce Company, December 30, 1904.

This seed was grown on the ranch of Mr. E. M. Brimall, Diamond Fork, Spanish Fork Canyon, Utah County, Utah, on land without irrigation, above water line in section 1, township 9 south, range 4 east. This land has grown alfalfa seed for nineteen years in succession, and this seed is from the nineteenth crop.

12410 to 12448.

Drug and medicinal seeds and plants ordered for the cooperative work conducted by Dr. R. H. True, of this Department.

12410 to 12422.

From Paris, France. Received thru Vilmorin-Andrieux & Co., 4 Quai de la Mégisserie, December 29, 1904.

12410. Aconitum napellus.
12411. Aconitum napellus.
12412. Hyoscyamus niger.
12413. Lavandula vera.
12414. Carum carui.
12415. Pyrethrum roseum.
12416. Pyrethrum cinerariaefolium.
12417. Thymus vulgaris.
12418. Rosmarinus officinalis.
12419. Satureja hortensis.
12420. Delphinium staphisagria.
12421. Ecballium elaterium.
12422. Origanum vulgare.

12423. Salvia officinalis. **Sage.**

From Philadelphia, Pa. Received thru W. Atlee Burpee & Co., November 30, 1904.

Broad-leaved.

12424 and 12425. Echinacea angustifolia.

From Manhattan, Kans. Received thru Mr. H. W. Baker, November 28, 1904.

12424. Plants.
12425. Seeds.

12410 to 12448—Continued.

12426 to 12441.

From Erfurt, Germany. Received thru Haage & Schmidt, December 24, 1904.

12426. Ecballium elaterium.

12427. Aconitum napellus.

12428. Aconitum napellus.

12429. Hyoscyamus niger.

12430. Lavandula vera.

12431. Carum ajowan.

12432. Origanum vulgare.

12433. Delphinium staphisagria.

12434. Pyrethrum roseum.

12435. Pyrethrum cinerariaefolium.

12436. Colchicum autumnale.

12437. Thymus vulgaris.

12438. Rosmarinus officinalis.

12439. Satureja hortensis.

12440. Bryonia alba.

12441. Bryonia dioica.

12442. Cassia angustifolia. **Senna.**

From Corpus Christi, Tex. Received thru Mr. H. H. Fisher, October 31, 1904.

12443 to 12446. Panax ginseng. **Ginseng.**

From Cuba, N. Y. Received thru Bates Ginseng Gardens, October 31, 1904.

12443. One-year-old roots.

12444. Two-year-old roots.

12445. Three-year-old roots.

12446. Germinated seed.

12447. Monarda fistulosa. **Wild bergamot.**

From Rochester, Mich. Received thru Mr. Wilfred A. Brotherton, November 14, 1904.

12448. Monarda punctata. **Horsemint.**

From La Crosse, Wis. Received thru Dr. E. C. Swarthout, October 28, 1904.

12449 and 12450. Dahlia spp. **Dahlia.**

From Guadalajara, Mexico. Received thru Mr. Federico Chisolm, December 27, 1904.

Seeds collected near Ixtlahuacan del Rio, Jalisco, Mexico, northwest from Guadalajara.

12449. White.

12450. Striped.

12451. Eutrema wasabi. **Japanese horse-radish.**

From Yokohama, Japan. Received thru the Yokohama Nursery Company, December 29, 1904.

(Described in detail in Bulletin No. 42 of the Bureau of Plant Industry.)

12452. Aralia cordata. **Kan udo.**

From Yokohama, Japan. Received thru the Yokohama Nursery Company, December 29, 1904.

(For description, see Bulletin No. 42 of the Bureau of Plant Industry.)

12453 to 12547. ORYZA SATIVA. **Rice.**

"Samples of rice received in answer to requests made of the various persons furnishing same, for testing in connection with the efforts now being made for the purpose of finding a variety resistant to the disease known as rotten-neck, threatening the rice-growing industry in the Carolinas." (*Fairchild.*)

12453 to 12463. **Rice.**

From Paris, France. Presented by Vilmorin-Andrieux & Co. Received July 29, 1904.

Samples of unhulled rice as follows:

12453. *Piemontese* rice, *Novarese.* One of the most valued for its yield and its quality. It is, however, grown in Lombardy on soil only which has carried a rice crop the previous season, as on fresh land it easily takes the disease called "brusone."

12454. *Piemontese* rice, *Bertone.* Usually grown on fresh land, is resistant to the "brusone," and the hulled rice is inferior to the *Novarese.*

12455. *Piemontese* rice, *Javanese.* Thrives on all kinds of land. It is pretty resistant to "brusone," but is very late, lacks quality and sheds its seeds too easily when being cut.

12456. *Piemontese* rice, *nostrano.* Takes too easily the disease "brusone," and is consequently little grown in Lombardy. It is somewhat used in the perpetual rice fields of the Po Valley, where it seems to be more resistant.

12457. *Piemontese* rice, *leoncino.* Very productive Japanese rice, of good quality, with a golden spike. Recommended for wet, compact, rich land.

12458. *Piemontese* rice, *francone.*

12459. *Egyptian* rice, *fino.*

12460. *Egyptian* rice, *sultanie.*

12461. *Egyptian* rice, *yamani.*

12462. *Dry Mountain* rice.

12463. Dry rice from Manchuria.

12464 to 12478. **Rice.**

From Colombo, Ceylon. Presented by Dr. C. Drieberg, superintendent of School Gardens. Received October 21 and 24, 1904.

12464. *Kurusivru* paddy. White grain in black husk. From Kegalle district.

12465. *Muttusamba* paddy. Superior variety for table use. From Kegalle district.

12466. *Kaiurusamba* paddy. From Kegalle district.

12467. *Kirinaran* paddy. From Bentota district.

12468. *Suduve* paddy. From Bentota district.

12469. *Yal-tatu-hel* paddy. From high elevation, Uva Province.

12470. *Mudu-kiri-hel* paddy. From high elevation, Uva Province.

12471. *Ceylon Carolina* paddy. From Hauwella, 30 miles inland from Colombo.

12472. *Ceylon Carolina* paddy. From Mount Lavinia, 7 miles south of Colombo.

12473. *Kiusui* (Japanese) paddy. Grown in the Government Stock Garden.

12474. *Ingrese we.* From Elakake, 4 miles inland from Bentatte, about halfway from Colombo to Galle.

12475. *Kuru-vi* paddy. From Madampe, Northwestern Province.

12453 to 12547—Continued.

12464 to 12478—Continued.

12476. *Rata-ri* paddy. From Madampe, North Central Province. Somewhat mixed with native varieties.

12477. *Puluk-hamban* paddy. From Kegalle district.

12478. *Rat-hel* paddy. Up-country grain, inclined to be white, tho husk is rather dark.

12479 to 12488. **Rice.**

From Singapore, Straits Settlements. Presented by Mr. R. Derry, assistant superintendent of the Botanical Gardens. Received November 9, 1904.

12479. *Arong* paddy. Used for making flour, and when cooked is hard and white. Always used by the natives.

Mr. Derry uses the term "paddy" to signify wet-land rice, and the term "pulot" to indicate dry-land rice.

12480. *Krencho* (or *Keroncho*) paddy. Used same as 12479; price same also.

12481. *Chemara-putri* paddy. Used same as 12479; price same also.

12482. *Seri-bumi* paddy. First-class flour for making cakes; pure white when cooked.

12483. *Seroupe* paddy. First-class flour for cakes and for the natives.

12484. *Radin* paddy. Used for rice by the natives.

12485. *Bunga-melong* pulot. Used for making cakes of any kind, but when cooked is hard and white.

12486. *Seong-ular* pulot. Use and price same as 12485.

12487. *Merah* pulot (or paddy). Use and price same as 12485.

12488. *Manek* paddy. Used only for feeding turtledoves and ringdoves.

12489 to 12512. **Rice.**

From Georgetown, Demerara, British Guiana. Presented by Mr. B. Howell Jones. Received in August, 1904.

12489. Rice of the kind usually grown in British Guiana.

12490 to 12511.

Samples experimentally grown at the Georgetown Botanical Gardens from imported Ceylon rice. They are distinguished by number only. Nos. 12490 to 12503 are "Ordinary rice." Nos. 12504 to 12511 are what are known as "Hill rice."

12512. From the Berbice River district.

12513 to 12515. **Rice.**

From Bulkeley, Ramleh, Egypt. Presented by Hon. Lionel Sandars. Received during the summer of 1904.

12513. *Yaban* (or *Yapani*) paddy. From Daira Draneht Pasha, Kafr-el-Dawar.

12514. *Soultani* (or *Sultani*) paddy. Same source as 12513.

12515. *Sabaini* (or *Sabini*) paddy. Same source as 12513.

12516 to 12518. **Rice.**

From Siam. Presented by the Arracan Company, of Bangkok, thru Dr. T. Heywood Hays, of that place. Received October 21, 1904.

12516. *Naichonchisee* paddy. Usually considered the finest quality in Bangkok.

12517. *Sakakrang* paddy. Good quality; long grain.

12518. *Paknampho* paddy. Medium quality.

12453 to 12547—Continued.

12519 to 12520. **Rice.**

From Italy. Presented by Messrs. Dammann & Co., San Giovanni a Teduccio, near Naples. Received October 3, 1904.

12519. *Italian.* No special name given.

12520. *Italian.* No special name given; probably the same kind as 12519.

12521. *Thessaly.* **Rice.**

From Greece. Presented by Mr. S. Xanthopaulo, Station Agricole, Patras. Received in August, 1904.

12522. **Rice.**

From Brazil. Presented by Consul Louis H. Aymé, Para. Received in August, 1904.

Rice paddy, like that grown in the districts of Guama and Irituba, in the State of Maranhac, Brazil, in a black loam, either overlying or mixt with sandy gravel and sandstone. The rice is called *Carolina.*

12523 and 12524. **Rice.**

From German East Africa. Presented by Mr. Udo von Katte, Plantage Kigome, Bezirk Tanga. Received October 5, 1904.

12523. *Nondro* paddy.

12524. *Kikanda* paddy.

12525 to 12547. **Rice.**

From Java. Presented by Mr. Charles A. Franc, Soerabaya, Java, Dutch East Indies. Received November 17, 1904.

12525 to 12540. *Ampenan* paddy.

12541. *Magetan* paddy.

12542. *Pekalongan* paddy.

12543. *Pekalongan* paddy.

12544. *Solo "A"* paddy.

12545. *Solo "B"* paddy.

12546. *Djember* paddy.

12547. *Djember* paddy.

12548. CRATAEGUS sp. (?)

From City of Mexico, Mexico. Received from Mr. G. Clark, thru Mr. G. Onderdonk, of Nursery, Tex., December 31, 1904.

This species of *Crataegus* is used in different parts of Mexico as a stock upon which the European and American type of pears are grafted. In a letter of May 30, 1904, Mr. Onderdonk describes the use of this stock as follows: "While there is to be found an occasional young *tijocate* growing in a cultivated lot with intention of being made a stock for pears by grafting where it stands, yet no nurseries of it exist. It grows wild in the most forbidding situations. The earliest fruits begin to ripen about the last of July, while the largest number mature about October or November. I saw many fine old pear trees in different parts of Mexico on *tijocate* stock, and for the European and American type of pears there can be *no better stock than tijocate.*"

12549. MEDICAGO SATIVA. **Alfalfa.**

From Buenos Aires, Argentina. Received thru Mr. Ronaldo Tidblom, August 12, 1905.

12550. POA PRATENSIS. **Kentucky bluegrass.**

From Winchester, Ky. Received thru Mr. D. S. Gay, December 2, 1904.

12551. (Undetermined.)

From Central Africa. Presented by Mrs. Anita N. McGee, 1620 P street, Washington, D. C. Received thru Mr. David Fairchild, December 31, 1904.

A single plant, said to be the first of its kind ever brought to America and to belong to the order Scitamineae. The plant was introduced by Mr. Vernon, who brought the Pigmies to the Louisiana Purchase Exposition. (*Fairchild.*)

12552. AMYGDALUS COMMUNIS. **Almond.**

From Niles, Cal. Received thru the California Nursery Company, January 4, 1905.

Jordan. "These trees are from stock introduced by Mr. John Rock, seed of which was submitted to the United States consul in Malaga, and pronounced the true Jordan type. They are not from trees of stocks introduced by this Department." (*Fairchild.*)

12553 to 12556. TERMINALIA sp. **Myrobalan.**

From New York, N. Y. Received thru A. Klipstein & Co., 122 Pearl street, July 11 and August 1, 1904.

12553. *Jubblepore*, No. 1.

12554. *Bhimleys*, No. 2.

12555. *Jubblepore*, No. 1.

12556. *Bimley*, No. 2.

"The fruits of the myrobalan contain one of the best tanning substances in the world. Large quantities of myrobalans are exported from India to England, and it is believed that the cultivation of these trees, of which there are evidently several species, may be a lucrative one in parts of California. The tree is known to be a drought-resistant species and suited to extremely hot climates. Some of the species are trees and, consequently, may withstand the slight cold to which they will be subjected in California." (*Fairchild.*)

12557 and 12558. ZEA MAYS. **Sweet corn.**

Selected seed corn for use in a series of experiments to determine the effect of soil, location, etc., on standard varieties of sweet corn, the idea being to distribute this seed to reliable parties in different localities, and to secure from them samples of the product for examination and further distribution.

12557. Received from Mr. A. N. Clark, Milford, Conn., March 25, 1904.

Stowell's Evergreen.

12558. Received from Mr. A. N. Clark, Milford, Conn., March 25, 1904.

Early Crosby.

12559 to 12561. ZEA MAYS. **Sweet corn.**

From Falls Church, Va. Received thru Mr. Upton Galligher, March 25, 1904.

12559. *Malakof.* Grown in 1903 from S. P. I. No. 9357.

12560. *Malakof.* Selected ears.

12561. *Malakof.* Grown in 1903 from S. P. I. No. 9356

12562. ZEA MAYS. **Sweet corn.**

From Auburn, N. Y. Received thru Mr. G. W. Boynton, May 6, 1904.

Malakof. Seed from selected amber ears, probably from same lot as S. P. I. No. 10401.

12563. ZEA MAYS. **Sweet corn.**

From Garrettsville, Ohio. Received thru Mr. George J. Streator, May 6, 1904.

Malakof. Seed from selected ears.

12564. DAHLIA sp. **Dahlia.**

From Guadalajara, Mexico. Received thru Mr. Federico Chisolm, December 30, 1904.

12565. LILIUM sp. **Lily.**

From Guadalajara, Mexico. Received thru Mr. Federico Chisolm, January 4, 1905.

12566 to 12576.

From Tunis, North Africa. Secured by Mr. Thomas H. Kearney during his exploration of Tunis. Received January 4, 1905.

A collection of economic plants as follows:

12566 to 12568. PUNICA GRANATUM. **Pomegranate.**

From the premises of M. Robert, Kalaâ Srira, Susa.

12566. Red fruited.

12567. *Chelfi.* White fruited.

12568. White-fruited variety from Gabes.

"These pomegranates are the best sorts grown in Tunis. The first two seem to be peculiar to Susa." (*Kearney.*)

12569 to 12573. OLEA EUROPAEA. **Olive.**

From the premises of M. Robert, Kalaâ Srira, Susa.

12569. *Baroumi* (fruit mucronate).

12570. *Baroumi* (fruit not mucronate).

"This is the largest olive in the country, and M. Robert's is about the only place where it can be secured." (*Kearney.*)

12571. *Zarazi* (?).

"This is a medium-sized olive and is the most-generally planted preserving olive in the country, being common even to the oases of the Jerid. It is probably a hardy sort, and one easily adapted to a variety of conditions. As soon as I see M. Minangoin I shall find out definitely if it is actually the *Zarazi* that I have obtained." (*Kearney.*)

12572. *Bidh Hammam.*

This is one of the largest olives of Tunis.

12573. *Chemlali.* From Sfax, Tunis.

"It is doubtful if this is a desirable sort, as the oil produced from it is said to contain too much margarin." (*Kearney.*)

12574 to 12576. MESEMBRYANTHEMUM spp.

From Sfax, Tunis.

12574. With yellow flowers.

12575. With rose-colored flowers.

12576. With rose-violet flowers.

"The first two kinds are used here as border plants, and also for holding banks at roadsides, while the last is made use of in the Jardin Publique as a lawn plant. These grow well in this dry soil without attention after the first two weeks after planting." (*Kearney.*)

12577. POTERIUM SANGUISORBA. **Burnett.**

From New York, N. Y. Received thru J. M. Thorburn & Co., January 5, 1905.

12578 to 12668. SOLANUM TUBEROSUM. **Potato.**

From Europe. Secured by Prof. L. R. Jones, of the University of Vermont, during a trip thru the potato-growing regions of Europe in 1904. Notes by Professor Jones.

12578 to 12596.

From Berlin, Germany. Received thru the Potato Culture Station, December 14, 1904.

12578.

Geheimrat Theil. (L. R. Jones's No. 1.) Originated by Richter. Skin white, flesh white. (See description in Berichte Deutsch. Kart.-Kult.-Stat., 1903, p. 53.)

Recommended by Professor Eckenbrecher and independently by his foreman, Mr. Goese, as showing a high degree of disease resistance and being a good general-purpose potato.

12578 to 12668—Continued.

12578 to 12596—Continued.

12579.

Sophie. (L. R. Jones's No. 2.) Originated by Cimbal. White skin, yellowish-white flesh. (See description in Berichte Deutsch. Kart.-Kult.-Stat., 1903, pp. 37 and 53.)

Recommended by Professor Eckenbrecher as one of the most productive of table varieties. Fairly resistant to disease; suited to various soils.

12580.

Dabersche. (L. R. Jones's No. 3.) Originator unknown. Skin pale red, flesh white-yellowish. (For further notes, see any of reports of Deutsch. Kart.-Kult.-Stat., e. g., 1903, pp. 34 and 53.)

This was ordered because it is the standard table variety in the trials of the German station. It is one of the most widely cultivated food potatoes in Germany; an old variety. Professor Eckenbrecher reports it as most liable to scab and liable to rot.

Sorauer says that it is suited to sandy soils. Foreman Goese says it is not suitable for heavy soils. Doctor Appel finds it one of the most resistant to "Schwarzbeinigkeit."

12581.

Richter's Imperator. (L. R. Jones's No. 4.) Originated by Richter. Skin white, flesh white. (For description, see any report of the Deutsch. Kart.-Kult.-Stat., e. g., 1903, pp. 35 and 52.)

Chosen for two reasons: (1) It is one of the most uniformly resistant to scab of the varieties reported upon by Professor Eckenbrecher for a long series of years. (2) It is taken at this German station as the typical heavy yielding factory potato. It is also a fair table variety. Not especially resistant to disease except scab; suited to all except wetter soils.

12582.

Magnum Bonum. (L. R. Jones's No. 5.) Originated by Sutton. Skin white, flesh white; a medium late variety which is a standard table potato of north central Europe. (See further description in Berichte Deutsch. Kart.-Kult.-Stat., 1903, pp. 43 and 53.)

Prunet, Frank, Sorauer, and others report this to be the most resistant to Phytophthora of any variety. Suited to all soils, according to Foreman Goese.

12583.

Irene. (L. R. Jones's No. 6.) Originated by Paulsen. Skin red, flesh white. (See further description in Berichte Deutsch. Kart.-Kult.-Stat., 1903, pp. 39 and 43.)

A medium late variety which has been found in the trials of this station second only to *Mohort* in resistance to diseases (rots, etc.). It is also very resistant to scab. According to Foreman Goese, suited to good soils but not to light sands.

12584.

Professor Maerker. (L. R. Jones's No. 7.) Originated by Richter. Flesh white. (See further description in Berichte Deutsch. Kart.-Kult.-Stat., 1897, p. 29; 1903, pp. 42 and 52.) This is a medium late variety, exceedingly productive, and a favorite sort in Germany for factory purposes, as well as a good table variety. It has shown good scab resistance, and was recommended by Foreman Goese and Professor Eckenbrecher for general disease resistance. Foreman Goese says that it is suited to all soils.

12585.

Silesia. (L. R. Jones's No. 8.) Originated by Cimbal. Flesh and skin white. (See further description in Berichte Deutsch. Kart.-Kult.-Stat., 1899, p. 35; 1903, p. 42.)

12578 to 12668—Continued.

12578 to 12596—Continued.

A very late variety. Very heavy yielder and high percentage of starch, therefore one of the highest in total starch product. Only fairly resistant to disease, but included upon recommendation of Professor Eckenbrecher. Foreman Goese says that it is suited to all soils.

12586.

Max Eyth. (L. R. Jones's No. 9.) Originated by Cimbal. This is a late potato, of good quality and starch content, described in the Berichte Deutsch. Kart.-Kult.-Stat.

Ordered because Foreman Goese stated that he considered this the most resistant variety toward Phytophthora, and added that it is suited to all soils.

12587.

Mohort. (L. R. Jones's No. 10.) Originated by Dolkowski. White skin, white flesh. (See further description in Berichte Deutsch. Kart.-Kult.-Stat., 1903, pp. 37 and 42.)

Selected because reported (1903, etc.) as the most highly resistant to diseases (rot, etc.) of any variety tested; also fairly resistant to scab. Excellent table variety; high yielder; high starch content. Foreman Goese says that it is suited to all soils.

12588.

Gastold. (L. R. Jones's No. 11.) Originated by Dolkowski. White skin, white flesh, middle late. (See further description in Berichte Deutsch. Kart.-Kult.-Stat., 1903, pp. 35 and 42.)

Selected because next to *President Krüger* this appears to be the most productive variety they have. Fair degree of general disease resistance. Esteemed alike for table and factory. Foreman Goese says that it is suited to all soils.

12589.

President Krüger. (L. R. Jones's No. 12.) Originated by Cimbal. White skin, white flesh, late variety. (See further description in Berichte Deutsch. Kart.-Kult.-Stat., 1903, pp. 35, 42, and 52.)

Selected because it has proved to be an enormous yielder, leading all varieties in most trials. It is of rather low starch content and recommended only for factory purposes. Foreman Goese says that it is suited to all good soils.

12590.

Professor Wohltmann. (L. R. Jones's No. 13.) Originated by Cimbal. Skin red, flesh white. (See further description in Berichte Deutsch. Kart.-Kult.-Stat., 1900, p. 35; 1903, pp. 43 and 52.) Late variety.

Selected because reported as highly resistant to scab. Large yielder and high starch content. Esteemed both for factory and table purposes. Foreman Goese says it needs a good, rich soil.

12591.

Topas. (L. R. Jones's No. 14.) Originated by Dolkowski. Skin white, flesh white. (See further description in Berichte Deutsch. Kart.-Kult.-Stat., 1900, p. 35; 1903, p. 42.) Medium early.

According to reports a good disease-resistant sort, good yielder, rich in starch, suitable for table and factory use.

Selected because Doctor Appel observed in 1902 that this showed the highest degree of resistance to Phytophthora of any variety in his fields. (See his article, "Die diesjährige Phytophthora-Epidemie," Deutsche Landw. Presse, XXIX, 685.) Foreman Goese says that it is suited to all soils.

12592.

Boncza. (L. R. Jones's No. 16.) Originated by Dolkowski. Skin red, flesh white, medium late. (See further description in Berichte Deutsch. Kart.-Kult.-Stat., 1901, p. 36; 1903, p. 42.)

12578 to 12668—Continued.

12578 to 12596—Continued.

This is not a very large yielder, but is very rich in starch (excelled all others in 1901); a very good table variety.

According to 1901 reports it is most highly resistant to disease (rots, etc) and also resistant to scab. Selected because of this. Mr. Goese says that it is suited to all soils.

12593.

Leo. (L. R. Jones's No. 17.) Originated by Pflug. Skin white, flesh white, medium late. (See further description in Berichte Deutsch. Kart.-Kult.-Stat., 1902, p. 35; 1903, pp. 42 and 52.)

This is not especially disease resistant, but was included upon recommendation of Professor Eckenbrecher, since it is one of the heaviest yielding varieties of high starch content and therefore very high total starch product on the average.

Medium late. Especially a factory variety, but also a good table potato. Mr. Goese says that it is similar to Richter's *Imperator*, and suited to all except moist soils.

12594.

Fuerst Bismarck. (L. R. Jones's No. 18.) Originated by Cimbal. Skin red, flesh white, late. (See further description in Berichte Deutsch. Kart.-Kult.-Stat., 1901, p. 37; 1903, p. 43.)

Exceedingly rich in starch and fair yielder. Recommended both for factory and table use. Professor Eckenbrecher has found this especially free from rot (Berichte, 1899), and it is included upon his recommendation for disease resistance. Mr. Goese says that it is suited for all good soils, but not for sand.

12595.

Apollo. (L. R. Jones's No. 19.) Originated by Paulsen. Skin white, white-yellowish. (See further description in Berichte Deutsch. Kart.-Kult.-Stat., 1901; also 1903, pp. 36 and 53.)

Highly productive for starch content; recommended first for factory use, but also as a table variety. Here included upon the personal recommendation of Professor Eckenbrecher, who has found, during three years' trials, that it is highly resistant to disease (rots, etc.) and fairly resistant to scab. Mr. Goese says that it is suited to all soils.

12596.

Gelbfleischige Speisekartoffel. (L. R. Jones's No. 20.) Originated by Cimbal. Skin white, flesh yellowish, rather late ripening. (See further description in Berichte Deutsch. Kart.-Kult.-Stat., 1903, pp. 40 and 53.)

This is a medium yielder, not recommended at all for factory purposes but as an excellent yellow-fleshed table potato. Included for this reason. It is reputed as rather susceptible to diseases. Mr. Goese says that it is suited to all soils.

12597 to 12601.

From Groningen, Holland. Received thru Mr. U. J. Mansholt, rijksbauwleeraar, November 30, 1904.

12597.

Eigenheimer. (L. R. Jones's No. 31.) Recommended by Mr. Mansholt as an early yellow-fleshed variety, good for table use, and resistant to Phytophthora.

12598.

Landskroon. (L. R. Jones's No. 32.) Recommended by Mr. Mansholt as a middle early white-fleshed potato, good for table use, and resistant to Phytophthora.

12599.

Eureka. (L. R. Jones's No. 33.) Recommended by Mr. Mansholt as a middle early variety for factory rather than table use, and resistant to Phytophthora.

12578 to 12668—Continued.

12597 to 12601—Continued.

12600.

Malador. (L. R. Jones's No. 34.) Recommended by Mr. Mansholt as a late, yellow-fleshed, good table variety, and resistant to Phytophthora.

12601.

Daisy. (L. R. Jones's No. 35.) Recommended by Mr. Mansholt as a late factory variety and resistant to Phytophthora.

12602 to 12607.

From Paris, France. Received thru Vilmorin-Andrieux & Co., September 22, 1904.

12602.

Belle de Fontenay. (L. R. Jones's No. 36.) Recommended by Vilmorin-Andrieux & Co. as a very early variety of high vigor and productiveness. Tubers oblong, skin and flesh yellow. Esteemed one of the best early potatoes; the standard in the Paris market. Stands shipment well and esteemed for "French fried" potatoes; prefers a fairly moist soil in France; recommended especially for trial in the South.

12603.

Brandale. (L. R. Jones's No. 37.) Recommended by Vilmorin-Andrieux & Co. as a very early variety with oblong tubers, yellow skin and yellow flesh, and worthy of trial in Florida.

12604.

Early Rose. (L. R. Jones's No. 38.) This is very extensively grown as an early potato in France, and is the only white-fleshed early potato Vilmorin-Andrieux & Co. could recommend. They consider it of high vigor and productiveness.

12605.

Chave (Shaw). (L. R. Jones's No. 39.) This is a standard French variety, round tubers, yellow flesh, and yellow skin. Recommended by Vilmorin-Andrieux & Co. as of high vigor and productiveness and worthy of trial in our Southern States.

Doctor Delacroix considers this the most resistant of the French varieties to Phytophthora and similar in this respect to *Magnum Bonum* among the English varieties.

12606.

Belle de Juillet. (L. R. Jones's No. 40.) Second early. Oblong tubers, skin and flesh yellow. Recommended for trial, especially in the South, by Vilmorin-Andrieux & Co. as an especially vigorous and productive variety. "I found what I take to be the same variety to be the favorite potato grown at Florence (Experiment Farm), for the northern export and trade. It is also grown and highly esteemed in Germany." (*Jones.*)

12607.

Quarantaine de la Halle. (L. R. Jones's No. 42.) This was described as a medium-early variety of high vigor and productiveness, recommended for trial culture in Florida, etc. Oblong tubers, skin and flesh yellow.

12608 to 12613.

From Reading, England. Received thru Sutton & Sons, December 31, 1904.

12608.

May Queen. (L. R. Jones's No. 51.) Sutton's origination. Very early; kidney shape, shallow eyes, yellow skin, a very handsome potato,

12578 to 12668—Continued.

12608 to 12613—Continued.

and reputed as of high quality and fair yield for so early a variety. Recommended by Sutton and various others as worthy of trial in Florida. Mr. Scarlett advises to plant whole tubers and rather close together, as tops are small.

12609.

Ninetyfold. (L. R. Jones's No. 52.) Originated by Sutton. "First early;" white skin and flesh. Good kidney shape but not quite so uniform and handsome as *May Queen*, and eyes somewhat deeper. Rated a better cropper. A good authority states "one of heaviest croppers among the first earliest; therefore profitable to grow, although quality is not of best." Opinions differ as to disease resistance. Various persons recommend this for trial in Florida, etc.

12610.

Epicure. (L. R. Jones's No. 53.) Originated by Sutton. A "second early" variety; bronzy red skin; flesh white; recommended highly by Sutton, but this is not indorsed by all others consulted. Secured especially for trials in South.

12611.

Supreme. (L. R. Jones's No. 54.) Originated by Sutton & Sons. A "second early," but a little earlier than *Epicure*. White. This makes a small top and is not altogether promising. It was, however, recommended by the Suttons for trial, especially in the South. It seemed comparatively free from "Schwarzbeinigkeit," as seen at Cambridge, England.

12612.

Windsor Castle. (L. R. Jones's No. 55.) A "second early" variety; yellow skin, white flesh, roundish, recommended by the Suttons as highest quality for table. It was also indorsed by others as worthy of trial, especially in the South.

12613.

Discovery. (L. R. Jones's No. 56.) This is one of Sutton's latest originations. It is medium late, yellow skin, white flesh, kidney shape, excellent quality and strong yielder. Sutton's people rate it as their greatest production, and the opinion of unbiased potato experts so far as consulted is that this is the most promising disease-resistant potato in England to-day.

12614 to 12619.

From Edinburgh, Scotland. Received thru Mr. T. A. Scarlett, December 31, 1904.

12614.

Sir John Llewellyn. (L. R. Jones's No. 57.) This is recommended most highly of all early potatoes in England.

Recently introduced by Harris, Wales; season is "first early;" white skin, white flesh, flattish-oval kidney shape, fine appearance and strong cropper, quality not of best; likes a good soil, and is a strong feeder. Said to have a tendency to develop sports. This is noteworthy, since it may prove more promising for selection of disease-resistant plants.

12615.

King Edward VII. (L. R. Jones's No. 58.) This is one of recently originated varieties. Sent out by Butler. Late second early. Pink skin, flesh white, said to yellow somewhat when cooked. Said to be productive but not of highest quality. Ordered on recommendation of W. P. Wright, secretary of the National Potato Society. Most other opinions given were adverse to its value as a disease resister.

12578 to 12668—Continued.

12614 to 12619—Continued.

12616.

Cramond Blossom. (L. R. Jones's No. 59.) Of recent origin in the Scotch village of Cramond. Season, "late second early." Oval. Recommended for our trials as a disease-resistant variety by W. P. Wright, secretary of the National Potato Society, but this opinion was not concurred in by several others. Mr. Scarlett finds it liable to disease; so also do the Suttons and Middleton.

12617.

Charles Fidler. (L. R. Jones's No. 60.) Recent origin, sent out by Fidler. This is a late potato, white, said by Mr. Lasham to be practically the same as the German variety *Imperator*, if not identical with that sort. Recommended as worthy of trial for disease resistance both by Mr. W. P. Wright, secretary of the National Potato Society and by men at the Cambridge University farm.

12618.

Factor. (L. R. Jones's No. 61.) This is one of the newer varieties sent out by Dobbie. It is late; very well spoken of by all. Closely resembles the popular standard *Up-to-Date*, but said to be of slightly better quality. Recommended for our trial by W. P. Wright, secretary of the National Potato Society; also by men at the Cambridge University farm, etc.

12619.

Duke of York. (L. R. Jones's No. 62.) This is one of the highly esteemed earlier varieties, recommended especially by the Cambridge University farm authorities. Also well spoken of by Mr. Scarlett.

12620 to 12642.

In addition to Jones's Nos. 57 to 63, ordered from Mr. Scarlett, the latter was authorized to include various others of the most promising Scotch potatoes which he judged worthy of trial. In accordance therewith, he included the following 23 varieties:

12620. *Langworthy.*
12621. *Tyne Kidney.*
12622. *Table Talk.*
12623. *Dalmeny Kidney.*
12624. *Crofter.*
12625. *Scottish Queen.*
12626. *Premier.*
12627. *Northern Star.*
12628. *Pink Blossom.*
12629. *Peacemaker.*
12630. *Dalmey Red.*
12631. *Dalmey Early.*
12632. *Sharpe Express.*
12633. *Midlothian Early.*
12634. *Southern Queen.*
12635. *Wylun Early.*
12636. *White Blossom.*
12637. *Red Kidney.*
12638. *Moneymaker.*
12639. *Sir Thomas Lipton.*
12640. *Radium.*
12641. *Acme.*
12642. *Heather Blossom.*

12643 to 12668.

From Cambridge, England. Received thru Mr. H. Henshaw, of Cambridge University farm, December 14, 1904.

12643. *Sutton's Discovery.*
12644. *Sutton's Supreme.*
12645. *Sutton's Ideal.*
12646. *Sutton's Flour Ball.*
12647. *Sutton's Ninetyfold.*
12648. *Findlay's Evergood.*
12649. *Findlay's Goodfellow.*

12578 to 12668—Continued.

12648 to 12668—Continued.

12650. *Findlay's Up-to-Date.*

12651. *Findlay's Northern Star.*

12652. *Findlay's British Queen.*

12653. *Fidler's Seedling.*

12654. *Charles Fidler.*

12655. *Carter's Snowball.*

12656. *Carter's Monarch.*

12657. *Kerr's Dumfries Model.*

12658. *Kerr's Duchess of Cornwall.*

12659. *Dobbie's Factor.*

12660. *Dobbie's Improved Kidney.*

12661. *Butler's King Edward VII.*

12662. *Sir John Llewellyn.*

12663. *Cramond Blossom.*

12664. *Langworthy.*

12665. *Duke of Rothesay.*

12666. *Royal Kidney.*

12667. *Duke of York.*

12668. *Empress Queen.*

12669. CUCUMIS MELO. **Muskmelon.**

From Boston, Mass. Received thru R. & J. Farquhar & Co., January 6, 1905.

Montreal Nutmeg.

12670. ULEX EUROPAEUS. **Gorse, whin, or furze.**

From Dublin, Ireland. Received thru Hogg & Robertson, January 6, 1905.

"Fresh roots covered with root tubercles, imported in cooperation with the Laboratory of Plant Physiology for the purpose of getting cultures of the micro-organism of these tubercles to be used in experiments in the introduction of the plants, the seed of which was introduced under No. 12408." (*Fairchild.*)

12671. MEDICAGO SATIVA. **Alfalfa.**

From Lawrence, Kans. Received thru F. Barteldes & Co., January 6, 1905.

12672 to 12677. OLEA EUROPAEA. **Olive.**

From Tunis, North Africa. Secured by Mr. Thomas H. Kearney. Received January 6, 1905. A collection of olive cuttings from the premises of M. Robert, Kalaâ Srira, Susa.

12672. *Souaba el Aljia.* An oil olive. Rather a small yielder, according to Minangoin.

12673. *Chaibi.* An uncommon but heavy yielding variety of oil olive that succeeds best in northern Tunis.

12674. *Semni* (butter). An olive which remains yellow green even when ripe; gives oil of very light color but of finest quality.

12675. *Khadraya* (green). An oil olive.

12676. *Kalb es Serdouk* (cock's heart). A small oil olive like Chemlali, yielding very heavily, adapted to dry lands.

12677. *Nebkri.* Gives oil of finest quality.

12678. PANICUM MAXIMUM. **Guinea grass.**

From Havana, Cuba. Received thru José Sagarminaga, seedsman, Obispo 66. January 7, 1905.

12679. ORYZA SATIVA. Rice.

From Yokohama, Japan. Received thru the Yokohama Nursery Company, January 5, 1905.

Sekai-ichi, meaning the "World's No. 1," grown in Iyo, Shikoku Province, which received the first prize in the last Osaka exposition and is recommended as the best and nearest quality to the *Carolina Golden* by Mr. Kenzo Ikeda, the president of the Agricultural Society of Japan. (*Fairchild.*)

12680. LILIUM PARDALINUM. Lily.

From Ukiah, Cal. Received thru Mr. Carl Purdy, January 5, 1904.

This lily is native to the Coast Range of mountains in California and Oregon. It is found at elevations varying from 1,000 to 5,000 feet. In its native state it is seen at its best growing along the edges of marshy valleys and in moist soil bordering springs and mountain streams. Under favorable conditions *Lilium pardalinum* increases from year to year, producing several new bulbs annually. Well-grown plants are quite as floriferous as the well-known St. Joseph's lily (*L. candidum*).

The flowers are arranged on long pedicels in an open raceme; the prevailing color is red or crimson, with the lower parts of the segments orange colored, and spotted with purple; the segments are much reflexed. There are, however, several varieties found in a wild state, varying from each other principally in the color of the flowers.

12681. CASTANEA VESCA. Chestnut.

From San Giovanni a Teduccio, near Naples, Italy. Received thru Damman & Co., January 7, 1905.

12682. GLADIOLUS hyb. Gladiolus.

From Chicago, Ill. Received thru Vaughan's Seed Store, January 7, 1905.

Princeps.

12683. NICOTIANA TABACUM. Tobacco.

From Wethersfield, Conn. Received thru Comstock, Ferre & Co., December 5, 1904.

Connecticut Seed Leaf.

12684 to 12692.

From Zaouia du Mornag, about 20 kilometers from Tunis, Tunis. Collected by Mr. T. H. Kearney, December 24, 1904, in the garden of M. Giraud, president of the Horticultural Society. Received January 9, 1905.

12684. OLEA EUROPAEA. Olive.

Bidh el Hammam. "The second largest olive of Tunis, and, according to Marzac, the best." (*Kearney.*)

12685. OLEA EUROPAEA. Olive.

Saiali Magloub. "One of the best of the medium-sized olives. According to Minangoin it is not a heavy yielder, but I did not get the impression that it is inferior in this respect to the large table olives. Probably Minangoin criticized it in this respect as an oil olive, but it is said to be excellent for the table." (*Kearney.*)

12686. CITRUS LIMONUM. Lemon.

Quatre Saisons. According to M. Giraud the best and the most widely grown lemon in Tunis; largely exported.

12687. CITRUS AURANTIUM. Orange.

Maltaise (No. 1). A smooth-skinned, deep-colored orange.

12688. CITRUS AURANTIUM. Orange.

Maltaise (No. 2). A smooth-skinned, large-leaved orange.

12684 to 12692—Continued.

12689. CITRUS AURANTIUM. **Orange.**

Maltaise (No. 3). Seedling.

12690. CITRUS AURANTIUM. **Orange.**

Blood, native variety.

12691. CITRUS BIGARADIA. **Bergamot orange.**

A smooth-skinned bigarade (bergamot?), said to be the best variety for making preserves.

12692. CITRUS AURANTIUM. **Orange.**

Trabelsi (Tripoli). The most abundant orange of Tunis.

12693. GARCINIA MORELLA. **Gamboge.**

From Kingston, Jamaica. Received thru Prof. William Fawcett, January 11, 1905.

"Seeds of the tree producing the true gamboge of commerce, which is procured principally from Siam and is used as a pigment for dyeing silks and other fabrics. The rind of the fruit is also used for tanning purposes. Introduced for the purpose of testing as a stock upon which to graft the mangosteen (*G. mangostana*). The gamboge has a hardier root system and is a very vigorous growing tree, and for this reason may prove of value as a stock." (*Fairchild.*)

12694 to 12696. MEDICAGO SATIVA. **Alfalfa.**

From Paris, France. Received thru Vilmorin-Andrieux & Co., January 7, 1905.

12694. Grown in Provence.

12695. Grown in Poitou.

12696. Grown in Italy.

12697. ZEA MAYS. **Sweet corn.**

From Philadelphia, Pa. Received thru Henry F. Michell Company, January 11, 1905.

Sugar Loaf.

12698. PISUM SATIVUM. **Pea.**

From New York, N. Y. Received thru J. M. Thorburn & Co., January 12, 1905.

Thomas Laxton.

12699 to 12701.

From New York, N. Y. Received thru J. M. Thorburn & Co., January 13, 1905.

Drug and medicinal seeds ordered for the cooperative work conducted by the Office of Drug Plant Investigations.

12699. DIGITALIS PURPUREA.

12700. FOENICULUM DULCE.

12701. PIMPINELLA ANISUM.

12702. MEDICAGO SATIVA. **Alfalfa.**

From Sherman, Tex. Received thru Mrs. R. E. Smith, January 13, 1905.

12703. ALLIUM FISTULOSUM. **Welsh onion.**

From Santa Clara, Cal. Received thru C. C. Morse & Co., January 14, 1905.

Forcing. Grown from S. P. I. No. 9301.

12704 to 12707.

A collection of vegetable seeds for special tests.

12708. MUSA TEXTILIS. **Manila hemp.**

From Manila, P. I. Grown from seed received by Mr. G. W. Oliver, from Prof. W. S. Lyon, Insular Bureau of Agriculture, January 29, 1904.

12709. HORDEUM TETRASTICHUM. **Four-row barley.**

From Bozeman, Mont. Received thru Prof. F. B. Linfield, Agricultural Experiment Station, January 12, 1905.

Hull-less.

12710. CYPERUS PAPYRUS. **Papyrus.**

From Paris, France. Received thru Vilmorin-Andrieux & Co., January 14, 1905.

12711 to 12715. ORYZA SATIVA. **Rice.**

From Yokohama, Japan. Presented by the Yokohama Nursery Company. Received January 12, 1905.

12711. *Banshiu honba.* Produce of Hiogo Ken.

12712. *Kairio.* From Shin-no-yen, Kasia Gun, Harima, 30 miles west of Kobe.

This "Kairio" seed quality is reported to be very strong against any diseases and endures injurious attacks. Produce of Hiogo Ken.

12713. *Futafushi wase.* Produce of Kanagawa Ken.

12714. *Makuno uchi.* Produce of Kanagawa Ken.

12715. *Kokeju.* Produce of Kanagawa Ken.

All of the above-named rices require only the ordinary rice cultivation practiced in Japan. They must have plenty of water from time of sowing till the ears are well formed.

12716. PSIDIUM MOLLE (?). **Guayabillo.**

From Guadalajara, Mexico. Received thru Mr. Federico Chisolm, January 14, 1905.

Packet of mixed seeds of strawberry and fig-flavored sorts collected at "La Trinidad," Guerrero, Mexico.

12717 to 12732.

A collection of vegetable seeds secured from various seedsmen for special testing purposes.

12733. BEGONIA sp. **Begonia.**

From Mount Vernon, N. Y. Received thru Mr. H. E. Le Page (representing Hubert & Co., Guernsey and Jersey, England), January 17, 1905.

Tuberous rooted.

12734. RHAMNUS PURSHIANA. **Cascara sagrada.**

From Olympia, Wash. Received thru Mr. A. W. McMurray, January 16, 1905.

Seedlings for cooperative work being conducted by the Office of Drug Plant Investigations.

12735. ATRIPLEX SEMIBACCATA (?). **Saltbush.**

From Tulare, Cal. Received thru Prof. A. V. Stubenrauch, January 17, 1905.

12736. PHASEOLUS VULGARIS. **Bean.**

From New York, N. Y. Received thru Peter Henderson & Co., January 16, 1905.

Bush Bountiful (green-podded).

12737. SECHIUM EDULE. **Chayote.**

From Dallas, Tex. Received thru Texas Seed and Floral Company, January 18, 1905.

12738. DAHLIA MERCKII. **Dahlia.**

From Edinburgh, Scotland. Received thru Prof. Bayley Balfour, regius keeper, Royal Botanic Garden, January 18, 1905.

This species is hardy at Edinburgh.

12739 to 12742. SACCHARUM OFFICINARUM. **Sugar cane.**

From Kingston, Jamaica. Received thru Mr. William Fawcett, director of Hope Gardens, January 16, 1905.

12739. *Bourbon.*

12740. *B. 306.*

12741. *D. 99.*

12742. *D. 115.*

12743. PHASEOLUS VULGARIS. **Bean.**

From Columbus, Ohio. Received thru the Livingston Seed Company, January 18, 1905.

Kenney's Rustless Golden Wax.

12744. BETA VULGARIS. **Sugar beet.**

From Santa Clara, Cal. Received thru C. C. Morse & Co., January 19, 1905.

"Grown on C. C. Morse & Co.'s farm at Gilroy, Cal., for the general trade. Not the product of chemically analyzed roots, but rather from roots selected according to shape, size, etc., judged by their external appearance." (*J. E. W. Tracy.*)

12745. BETA VULGARIS. **Sugar beet.**

From Fairfield, Wash. Received thru Mr. E. H. Morrison, January, 1905. Crop of 1904.

"Grown on E. H. Morrison's farm at Fairfield, Wash., for the general trade, from roots selected according to shape, size, etc., judged for their external appearance only." (*J. E. W. Tracy.*)

12746. PISTACIA VERA. **Pistache.**

From Tashkend, Russian Central Asia. Received thru Mr. H. W. Dürrschmidt, January 20, 1905.

12747. MEDICAGO SATIVA. **Alfalfa.**

From Billings, Mont. Received thru Mr. I. D. O'Donnell, January 19, 1905.

12748. MEDICAGO SATIVA. **Alfalfa.**

From Paris, France. Received thru Vilmorin-Andrieux & Co., January 20, 1905.

Seed grown in the state of Hesse, Germany, and is known as *Eifeler Luzerne* in the Rhine Province.

12749 and 12750. CUCURBITA sp. **Squash.**

From Garrett Park, Md. Received thru Mr. D. S. Bliss, January 21, 1905. Grown from S. P. I. No. 9481 during the season of 1904.

12749. Large cylindrical sort.

12750. Crook-neck.

"The seeds of the large sort are from the first fruit that formed before any blossoms showed on any other vines, and, so far as I know, there were no other vines nearer than half a mile. The seeds of the smaller fruits are from a dozen mixed." (*Bliss.*)

12751. (Undetermined.)

From Barberton, Africa. Received thru Hon. W. Stanley Hollis, United States consul at Lourenço Marquez, Africa, January 14, 1905.

"A very fine, edible 'plum,' which grows in the mountains near Barberton on trees about 6 feet high." (*Hollis.*)

12752. Dolichos uniflorus. **"Kulthi."**

From Quard Hitlow Koppa, Mysore Province, India. Received thru Mr. W. Maxwell Maynard, January 20, 1905.

"According to Mr. Maynard this legume is grown extensively in India and fed to horses and working bullocks and is also considered valuable for using in the coffee estates. Sent by Mr. Maynard to Dr. George T. Moore for the purpose of interesting him in the cultivation of the micro-organism which forms the nodules on this as well as other leguminous plants." (*Fairchild.*)

12753 and 12754. Olea europaea. **Olive.**

From Sousse, Tunis. Collected by Mr. T. H. Kearney. Received January 21, 1905.

12753. *Barouni.*

12754. *Yacouti.*

12755. Cornus kousa.

From New York, N. Y. Received thru Henry & Lee, 97 Water street, January 23, 1905.

12756. Brassica nigra. **Black mustard.**

From Philadelphia, Pa. Received thru W. A. Burpee & Co., January 24, 1905.

Fordhook Fancy.

12757. Bambusa striata. **Bamboo.**

From Niles, Cal. Received thru the California Nursery Company, January 25, 1905.

12758. Cyphomandra betacea. **Tree tomato.**

From Kingston, Jamaica. Received thru Mr. G. N. Collins, January, 1905.

"This is a species of South American shrub from the mountainous regions of Brazil, adjacent to Peru. Cultivated occasionally for the egg-shaped, reddish-brown, faintly striped fruits. Fruits about 2 inches long on slender stalks, 2 celled, seedy, musky acid and tomato-like in flavor; agreeable to those who like tomatoes." (*Bailey.*)

Bears the second or third year from seed under glass. This tomato has been successfully introduced into Jamaica, Ceylon, and other mountainous regions of the Tropics, and in many places is considered a valuable addition to the list of garden vegetables. It would, in all probability, thrive in Porto Rico. (*Cook and Collins, Contr. Nat. Herb.*, VIII, p. 132.)

"Succeeds best with a mean annual temperature of 68° F. Can be propagated readily from seed in warm countries." (*Bailey's Forcing Book.*)

12759 and 12760. Oryza sativa. **Rice.**

From Buitenzorg, Java. Received thru Doctor Treub, of the Botanical Gardens, December 5, 1904.

12579. *Tjiomas.*

12760. *Carolina.*

12761 to 12765. Oryza sativa. **Rice.**

From Yokohama, Japan. Presented by the Yokohama Nursery Company. Received December 12, 1904.

Unhulled rice as follows:

12761. *Bankoku ichi.*
12762. *Jugoya.*
12763. *Makuno uchi.*
12764. *Sekitori.*
12765. *Ko-zo.*

12766 to 12768.

From Wonsan, Korea. Received thru Mr. C. F. S. Bilbrough, Chosen Holme, January 21, 1905.

12766. ORYZA SATIVA. **Rice.**

With a light husk.

12767. ORYZA SATIVA. **Rice.**

With dark-brown husk.

12768. CLERODENDRON sp.

12769. DELPHINIUM sp. **Larkspur.**

From Holland, Mich. Received thru Mrs. H. Kremers, January 25, 1905.

12770. CUCUMIS MELO. **Muskmelon.**

From Augusta, Ga. Received thru Alexander Seed Company, January 21, 1905.

Nixon.

12771. CITRULLUS VULGARIS. **Watermelon.**

From Philadelphia, Pa. Received thru Mr. William Henry Maule, January 21, 1905.

Harris's Earliest.

12772. MEDICAGO SATIVA. **Alfalfa.**

From Dell, Oreg. Received thru Mr. M. D. Kelley, January 26, 1905.

Grown from S. P. I. No. 9450.

12773. CASTANEA CRENATA. **Japanese chestnut.**

From New York City. Presented by Mr. F. W. Bruggerhof, president of the J. M. Thorburn Company, 36 Cortlandt street. Received January 25, 1904.

12774. LINUM USITATISSIMUM. **Flax.**

From Pskoff, Russia. Received thru Malcolm & Co., January 21, 1905.

12775. PHASEOLUS RADIATUS. **Mung bean.**

From Calhoun, S. C. Received thru Mr. C. C. Newman, January 27, 1905.

Newman.

12776. DODECATHEON MEADIA. **Shooting-star.**

From Takoma Park, D. C. Received thru Mr. A. J. Pieters in the autumn of 1904.

12777 to 12779.

From Murtee Station, Wilcannia, New South Wales, Australia. Presented by Mr. E. W. Davis. Received January 28, 1905.

Seeds of native plants.

12777. ATRIPLEX NUMMULARIA. **Old-man saltbush.**

12778. ATRIPLEX HOLOCARPA. **Annual saltbush.**

12779. TETRAGONIA EXPANSA. **New Zealand spinach.**

12780 and 12781.

From Cape Town, South Africa. Presented by Prof. J. Burtt Davy, government agrostologist and botanist. Received January, 1905.

12780 and 12781—Continued.

12780. FICUS sp.

"From southern Rhodesia. Well worth cultivating; very large tree; suitable for southern California, Florida, and Louisiana." (*Davy.*)

12781. ACACIA sp.

"From southern Rhodesia. Well worth cultivation in southern California and southern Florida." (*Davy.*)

12782 and 12783. PISTACIA VERA. **Pistache.**

From Bronte, Sicily. Collected by Mr. Thomas H. Kearney. Received January 30, 1905.

12782. Staminate cuttings. **12783.** Carpellate cuttings.

12784. MEDICAGO SATIVA. **Alfalfa.**

From Ogden, Utah. Received thru the C. A. Smurthwaite Produce Company, January 30 and March 9, 1905.

This seed was raised in Emery County, Utah, on land that is irrigated. The land has been cropt for forage for fifteen years, and in 1904 it was cropt for seed for the first time. This seed was taken from second growth.

12785. PAPAVER RHOEAS. **Shirley poppy.**

From Santa Clara, Cal. Received thru C. C. Morse & Co., January 30, 1905.

Santa Rosa, a new variety originated by C. C. Morse & Co.

12786 to 12789. SACCHARUM OFFICINARUM. **Sugar cane.**

From Trinidad, British West Indies. Received thru Mr. J. H. Hart, superintendent of the Botanical Gardens, January 29, 1905.

12786. *T. 105.* **12788.** *T. 223.*

12787. *T. 215.* **12789.** *T. 230.*

12790 to 12800.

From New South Wales, Australia. Received thru Mr. H. W. Potts, principal of the Hawkesbury Agricultural College, February 1, 1905.

A collection of seeds as follows:

12790. ACACIA BAILEYANA. **Cootamundra wattle.**

12791. ACACIA ELONGATA. **"Sally" wattle.**

Tall shrub or small tree.

12792. ACACIA LINEARIS. **Wattle.**

12793. ACACIA LUNATA. **"Golden Glory" wattle.**

A handsome shrub with dense masses of golden-yellow flowers rising 4 to 5 feet.

12794. ACACIA TRINERVATA. **Mountain wattle.**

12795. BOSSIAEA RHOMBIFOLIA.

A native, rigid, small shrub, the pods characteristically attacked by an Aecidium.

12796. CASUARINA SUBEROSA.

A tree pinelike in appearance, with leafless, jointed branches.

12797. DODONAEA VISCOSA.

A shrub rising to from 4 to 6 feet.

12790 to 12800—Continued

12798. ELAEOCARPUS CYANEUS.

A small tree.

12799. ERAGROSTIS PILOSA. **Weeping love grass.**

12800. KENNEDYA RUBICUNDA

A scarlet-flowered creeper.

12801. MEDICAGO SATIVA. **Alfalfa.**

From Mulock, Tex. Received thru Mr. J. M. Simmons, February 1, 1905.

12802. ALNUS MARITIMA JAPONICA. **Alder.**

From New York, N. Y. Received thru Suzuki & Iida, February 2, 1905.

"A deciduous tree growing in wet places, attaining a height of 20 to 30 feet. In spring it produces male and female flowers separately before it sprouts. The male flowers hang down from the branches in the form of a catkin, and the female flowers yield round fruits with scales. In the autumn when the fruits fully ripen, being about 1 inch in length, they are collected and dried for dyeing." (*Useful Plants of Japan.*)

"This plant is considered essential in the cultivation of the Japanese paper plant, mitsumata. It is used as a 'shelter' plant and is invariably planted on the plantation of the paper plant. It is doubtful if the effect accredited to this plant, viz, shade and shelter, is the real reason for its culture.

"It has been suggested by Mr. W. T. Swingle that since the genus Alnus has a root system bearing root nodules which store up nitrogen that this plant enriches the soil in which the paper plants are grown. This plant should be carefully studied relative to this particular point." (*Fairchild.*)

12803. MEDICAGO SATIVA. **Alfalfa.**

From Setif, Algeria. Received thru Mr. G. Ryf, Setif, February 2, 1905.

Getula. "This variety of alfalfa is said by Mr. Ryf, who has devised a most ingenious method of cultivating alfalfa and wheat on the same land at the same time, to be more drought resistant than the ordinary French lucern, and it is believed that this variety may prove of special value in experiments in the arid regions of our Southwest." (*Fairchild.*)

12804. JUNCUS EFFUSUS (?). **Matting rush.**

From Chico, Cal. Received thru Mr. P. H. Dorsett, Plant Introduction Garden, February 13 and 20, 1905.

"Plants of the California rush for experiments in the culture of the matting rush." (*Fairchild.*)

12805. HUMULUS LUPULUS. **Hop.**

From Nuremberg, Germany. Received thru S. B. Bing Sons, hop merchants, September 30, 1904.

Saaz City.

12806. HUMULUS LUPULUS. **Hop.**

From Puyallup, Wash. Received thru Mr. W. H. Lawrence, assistant at the Agricultural Experiment Station, November 14, 1904.

12807. HUMULUS LUPULUS. **Hop.**

From Germany. Received November, 1904.

12808. ORYZA SATIVA. **Rice.**

From Colombo, Ceylon. Presented by Dr. C. Drieberg, superintendent of School Gardens. Received January 28, 1905.

Grown in the Hambantote district.

12809. ANACARDIUM OCCIDENTALE. **Cashew nut.**

From Salisbury, Rhodesia, South Africa. Received thru Mr. George M. Odlum, Department of Agriculture, February 3, 1905.

From wild trees in Portuguese East Africa that seem to bear more freely than those cultivated in the West Indies and may prove hardier.

12810 and 12811.

From Portuguese East Africa. Presented by Hon. Stanley Hollis, United States consul, Lourenço Marquez, thru the Assistant Secretary of State. Received January 28, 1905.

12810. (Undetermined.) **Matundulaku.**

Fruits of a sour "plum" sent to Mr. Hollis by Mr. A. E. Graham-Lawrence, of Barberton.

12811. GARCINIA LIVINGSTONEI. **Pimbe.**

A Lourenço Marquez wild "plum."

12812. (Undetermined.)

From Hankow, China. Presented by Dr. L. S. Wilcox, United States consul-general. Received January 31, 1905.

12813. BRASSICA OLERACEA. **Cabbage.**

From Norton, N. C. Received thru Mr. B. Norton, February 2, 1905.

North Carolina Buncombe.

12814. ARACHIS HYPOGAEA. **Peanut.**

From Marseille, France. Received thru Hon. Robert P. Skinner, United States consul-general, February 3, 1905.

"A sample of 'Arachides' from the province of Sine in Senegal. These are the very best nuts known in this market for the manufacture of oil." (*Skinner.*)

12815. PISTACIA VERA. **Pistache.**

From near Caltanisetta, Sicily. Received thru Mr. T. H. Kearney, February 4, 1905.

Trabonella.

12816. MEDICAGO SATIVA. **Alfalfa.**

From Chinook, Mont. Received thru the Thomas O'Hanlon Company, February 6, 1905.

Grown by Mr. F. T. Reser, 1 mile west of Chinook.

12817. PHASEOLUS VULGARIS. **Bean.**

From Leroy, N. Y. Received thru Mr. A. N. Jones, February 25, 1905.

Golden Crown Wax.

12818. PHASEOLUS VULGARIS. **Bean.**

From Chaumont, N. Y. Received thru Roger Brothers, February 25, 1905.

Golden Carmine-Podded Horticultural.

12819. LIPPIA REPENS.

From Santa Barbara, Cal. Received thru Dr. F. Franceschi, February 10, 1905.

12820. MEDICAGO SATIVA. **Alfalfa.**

From Clearwater, Nebr. Received thru Mr. G. E. Miller, February 7, 1905.

12821. PSIDIUM MOLLE. **"Guayabillo."**

From Guadalajara, Mexico. Received thru Mr. Federico Chisolm, February 4, 1905.

12822 to 12831. AMYGDALUS COMMUNIS. **Almond.**

From Girgenti, Sicily. Received thru Mr. T. H. Kearney, February 6, 1905.

Varieties of almond cuttings selected by Mr. Casá from his collection of 25 varieties.

12822. Sweet; big fruit.
12823. Sweet; long fruit.
12824. Sweet; fruit dark red.
12825. Sweet; fruit double.
12826. Bitter.
12827. Sweet, with "a point at one side" (end).
12828. Tender, sweet; good for table.
12829. Early flowering, sweet, hard-shelled.
12830. Not frost resistant.
12831. Late flowering; resistant to frost.

12832 to 12842.

From Catania, Sicily. Received thru Mr. T. H. Kearney, February 8, 1905.

12832 to 12835.

Received from Salvatore Leanza, nurseryman, Catania, Sicily.

12832. ERIOBOTRYA JAPONICA. **Loquat.**

"A valuable and distinct, semiseedless grafted variety, which may be especially recommended. Fruit especially large, pear-shaped, with a fleshy, juicy, sugary pulp; with a few small seeds, which are in some cases extremely small according to the modification produced by their surroundings, whether in pots or in open ground with a ball of earth." (*Kearney.*)

12833 and 12834. CORYLUS AVELLANA. **Filbert.**

Castiglione.

12835. PISTACIA VERA. **Pistachc.**

Bronte.

12836 to 12842. OPUNTIA spp. **Prickly pear.**

Presented by Doctor Cavara, of the Catania Botanical Gardens, Sicily.

12836. OPUNTIA TOMENTOSA.

A variety of opuntia that holds its fruit all winter. (Doctor Cavara's No. 5.)

12837. OPUNTIA FICUS INDICA.

"Fructu albo, vulgo 'Zuccherina.'" (Doctor Cavara's No. 2.)

12838. OPUNTIA FICUS INDICA.

"Fructu albo, vulgo 'Sipala.'" (Doctor Cavara's No. 1.)

12839. OPUNTIA FICUS INDICA.

"Fructu flavo, vulgo 'Figu d'India.'" (Doctor Cavara's No. 4.)

12840. OPUNTIA FICUS INDICA.

"Fructu rubro, vulgo 'Sanguigua.'" (Doctor Cavara's No. 3.)

12832 to 12842—Continued.

12836 to 12842—Continued.

12841. OPUNTIA FICUS INDICA.

"Fructu flavo-carne, compacta, vulgo 'Brontese.'" (Doctor Cavara's No. 7.)

12842. OPUNTIA FICUS INDICA.

"Fructu albo-venosa." (Doctor Cavara's No. 6.)

12843 to 12845. CUCURBITA sp. **Squash.**

From Yokohama, Japan. Received thru the Yokohama Nursery Company, February 7, 1905.

12843. *Kikugata* (early).

12844. *Chilimen* (early).

12845. *Kikuza* (late).

12846 to 12848.

From Tunis. Received thru Mr. T. H. Kearney, December 28, 1904.

12846. MEDICAGO SATIVA. **Alfalfa.**

Oasis. From Kebili.

12847. MEDICAGO SATIVA. **Alfalfa.**

Tripoli. From Gabes.

12848. PISTACIA VERA. **Pistache.**

From Sfax. Nuts from the 1904 crop.

12849. CANNABIS SATIVA. **Hemp.**

From Nicholasville, Ky. Received thru W. L. Steel & Co., February, 1904.

12850. FEIJOA SELLOWIANA.

From Sao Paulo, Brazil. Presented by Mr. Alberto Löfgren, Botanic Gardens. Received March 11, 1905.

"A plant belonging to the guava family. Plants of this new fruit have been grown by Mr. Taft and Doctor Franceschi in southern California, and small immature fruits have been borne by single plants grown by these parties. The plant has been successfully cultivated on the Riviera, where there are several specimens of considerable size which have borne excellent fruit. Doctor André, who has paid special attention to this fruit, pronounces it, in flavor, something exceptionally delicious. The fruits are about the size of a large English walnut, green in color and covered with blunt protuberances. Little is known at the present time in this country regarding the actual flavor of the fruit. The fruit is of a character which enables it to be plucked from the bush before ripening. It is believed that this plant can be grown successfully in all the frostless regions of the Southwest. It is well worthy of serious consideration by all those interested especially in subtropical fruit culture." (*Fairchild.*)

12851. PENNISETUM TYPHOIDEUM. **Pearl or cat-tail millet.**

From Augusta, Ga. Received thru the N. L. Willet Drug Company, March 13, 1905.

12852. ORYZA SATIVA. **Rice.**

From Augusta, Ga. Received thru the N. L. Willet Drug Company, March 13, 1905.

12853. TRITICUM DICOCCUM. **Emmer.**

From Lawrence, Kans. Received thru F. Barteldes & Co., February 22, 1905.

12854. HORDEUM VULGARE. **Barley.**

From Geneva, Idaho. Received thru Mr. F. W. Boehme, March 15, 1905.

12855. SECALE CEREALE. **Rye.**

From Geneva, Idaho. Received thru Mr. F. W. Boehme, March 15, 1905.

12856 to 12861.

From Vomero, Naples. Presented by Dr. Carl Sprenger thru Mr. E. A. Bessey. Received January, 1905.

12856. RICINUS ZANZIBARIENSIS. **Castor-oil plant.**

Package of mixed varieties.

12857. SESBANIA TRIPETII. **Red acacia.**

"One of the finest flowering shrubs."

12858. RHAMNUS ALATERNUS CALABRICA.

12859. MORUS ALBA. **White mulberry.**

China.

12860. SIDERITIS MASSONIANA. **12861.** PICRASMA AILANTHOIDES.

12862 to 12864.

From Paris, France. Received thru Vilmorin-Andrieux & Co., February 10, 1905.

12862. CYNARA SCOLYMUS. **Artichoke.**

Large flat *Brittany.*

12863. CUCUMIS SATIVUS. **Cucumber.**

12864. SANVITALIA PROCUMBENS FLORE PLENO.

12865 to 12871. ORYZA SATIVA. **Rice.**

From Calcutta, India. Presented by I. H. Burkill, esq., M. A., officiating reporter on economic products to the government of India, Indian Museum, 1 Sudder street. Received February 9, 1905.

12865. *Masiua ghaiya.* From Bengal Province.

12866. *Bhadai ghaiya,* red. From Bengal Province.

12867. *Thosar Bhadai ghaiya,* white. From Bengal Province.

12868. *Pakhasali Bhadai.* From Bengal Province.

12869. *Augua Bhadai.* From Bengal Province.

12870. Small red variety. From Bengal Province.

12871. *Takmaroo ghaiya.* From Bengal Province.

This paddy was grown by the Lepchas and Bhootias.

12872. CHRYSANTHEMUM ANETHIFOLIUM. **Chrysanthemum.**

From Merrifield, N. Dak. Presented by Mrs. H. E. Bancroft. Received February, 1905.

Mrs. Bancroft writes that this is a perennial there, but blossoms early the first year from seed. The largest blossoms are the early ones, being three times as large as those sent, which were gathered on November 13, 1904.

12873. ESCHSCHOLTZIA CALIFORNICA. **California poppy.**

From Merrifield, N. Dak. Presented by Mrs. H. E. Bancroft. Received February, 1905.

Mrs. Bancroft writes that by constant selection she has developed a strain of California poppy with flowers much larger than the ordinary, which continue in bloom much later than the common kind.

12874 to 12876. ORYZA SATIVA. **Rice.**

From Canton, China. Presented by Mr. T. E. Griffith. Received January 28, 1905.

Samples of Chinese rice, as follows:

12874. "*Shie-Miu.*" (No. 1.)
12875. "*Ai-Miu.*" (No. 2.)
12876. "*Laer-Chap.*" (No. 3.)

"As to the local manner of planting this rice, a seed bed some 30 yards square is prepared alongside of the large rice fields about the month of August. This seed bed is composed of softish mud, and the grain is scattered over the surface, which is kept wet enough to cause it to sprout. In about three weeks' time the mass of seedlings are about 10 inches in height, when they are taken up and planted out in the rice fields in bunches of 20 or so seedlings together, at intervals of a foot between bunches.

"The soil of the fields is a bluish alluvial mud, and, after planting, it is kept constantly inundated with water from the numerous creeks which intersect the country. In about one hundred days from planting out the grain is ripe, and is then gathered in." (*Griffith.*)

12877 to 12895.

From New Zealand. Presented by the government of New Zealand thru Mr. M. A. Carleton. Received February 11, 1905.

A collection of grains, etc., from the New Zealand exhibit at the Lousiana Purchase Exposition, St. Louis, Mo., 1904.

12877 to 12882. AVENA SATIVA. **Oat.**

12877. *Danish.*
12878. *Dun.*
12879. *Sparrowbill.*
12880. *Canadian.*
12881. *White Tartar.*
12882. *Black Tartar.*

12883 to 12886. TRITICUM VULGARE. **Wheat.**

12883. *Pearl.*
12884. (No label.)
12885. *Hunter's.*
12886. *Tuscan.*

12887 to 12889. PISUM SATIVUM. **Pea.**

12887. *Brown.* (Marked "B.")
12888. *Green.* (Marked "C.")
12889. *Green.*

12890. TRIFOLIUM REPENS. **White clover.**

12891. TRIFOLIUM PRATENSE. **Red clover.**

Colonial.

12892. LOLIUM ITALICUM. **Italian rye-grass.**

12893. LOLIUM PERENNE. **Perennial rye-grass.**

12894. PHLEUM PRATENSE. **Timothy.**

Colonial.

12895. DACTYLIS GLOMERATA. **Orchard grass.**

12896. LILIUM NEILGHERRENSE. **Neilgherry lily.**

From Utakamund, India. Received thru Mr. G. H. Cave, superintendent of the Government Botanic Gardens, February 14, 1904.

12897 to 12899.

From Durban, Natal. Presented by Mr. J. Medley Wood, director of the Botanic Gardens. Received February 14, 1905.

12897. COFFEA ZANGUEBARIAE (?). **Coffee.**

"According to a letter of January 12, 1905, from Mr. Wood, this species of Coffea, regarding the identification of which he is doubtful, is quite immune

12897 to 12899—Continued.

to attacks of the *Hemileia vastatrix*. It is grown in the Botanic Gardens within a few feet of Coffea plants covered with this fungus, and Mr. Wood has endeavored to inoculate the plant with it but has been unsuccessful. He further states that it is a handsome shrub, in addition to its value for hybridizing purposes for *Coffea arabica* or other species. His idea is, further, that it might be used as a stock upon which to graft the Arabian Coffea." (*Fairchild.*)

12898. Asparagus virgatus.

"According to Mr. Wood this species is cultivated in Natal and is considered to have a distinct flavor of its own and to be a desirable vegetable. This same species has been in cultivation in America for some time as an ornamental." (*Fairchild.*)

12899. Passiflora edulis.

"In Natal one of the commonest fruits on the market is this passion fruit. Its cultivation requires very little attention and it seems to be a very productive vine. This could be cultivated to advantage in the frostless regions of California and Florida, and attempts should be made to cross it with the Maypop, which is a common species of Passiflora growing in the Carolinas In New Zealand and Australia the fruit has become a popular one on the market." (*Fairchild.*)

12900 to 12908.

From Washington, D. C. Grown on the Potomac Flats under the direction of Dr. R. H. True, Physiologist in Charge of Drug and Medicinal Plant Investigations. Received February 5, 1905.

A collection of drug and medicinal plant seeds, as follows:

12900. Atropa belladonna. **Belladonna.**

12901. Carum carvi. **Caraway.**

12902. Conium maculatum. **Poison hemlock.**

12903. Coriandrum sativum. **Coriander.**

12904. Lobelia inflata. **Lobelia.**

12905. Satureja hortensis. **Summer savory.**

12906. Papaver somniferum. **Poppy.**

A white-seeded opium poppy.

12907. Papaver somniferum. **Poppy.**

A blue-seeded opium poppy.

12908. Chenopodium anthelminticum. **American wormseed.**

12909. Sechium edule. **Chayote.**

From New Orleans, La. Received thru the J. Steckler Seed Company, February 11, 1905.

12910. Olea europea. **Olive.**

From Tunis, North Africa. Received thru Mr. T. H. Kearney, February 13, 1905.

Chitoni. "This is the principal and best oil variety of northern Tunis, but is said not to do so well in drier and hotter parts." (*Kearney.*)

12911 to 12917.

From Brookings, S. Dak. Received thru Prof. N. E. Hansen, Agricultural Experiment Station, January 18, 1905.

A collection of ornamentals, as follows:

12911. (Undetermined.) **"Siberian sand thorn."**

12911 to 12917—Continued.

12912. CARAGANA MICROPHYLLA.

12913. CARAGANA ARBORESCENS. **Siberian pea tree.**

12914. SALIX sp. **Niobe weeping willow.**

12915. ROSA RUGOSA. **Pasture rose.**

12916. SALIX sp. **Ural willow.**

12917. SALIX VIMINALIS REGALIS.

12918. BETA VULGARIS. **Sugar beet.**

From Fort Collins, Colo. Received thru the Colorado Experiment Station, February 14, 1905.

Kleinwanzleben.

12919. RAPHANUS SATIVUS. **Radish.**

From Fairfield, Wash. Received thru Mr. E. H. Morrison, February 13, 1905.

Crimson Giant Forcing. Grown from S. P. I. No. 9487.

12920. NICOTIANA TABACUM. **Tobacco.**

From Washingtonboro, Lancaster County, Pa. Received thru Mr. Frank C. Wittmer, February 14, 1905.

12921 to 12926.

From Sfax, Tunis, North Africa. Received thru Mr. T. H. Kearney, February 17, 1905.

12921. OLEA EUROPAEA. **Olive.**

"The *Chemlali* variety, being probably the best adapted of all olives to a dry, hot climate, will be useful as a stock even if it does not succeed with us as an oil variety." (*Kearney.*)

12922. PISTACIA VERA. **Pistache.**

White-skinned variety.

12923. PISTACIA VERA. **Pistache.**

Red-skinned variety.

12924. PISTACIA VERA. **Pistache.**

Male.

"Through the kindness of Mr. Leonardi, British vice-consul, I was able to visit a garden here (Sfax) belonging to two Italian Jews, where there are 16 pistache trees (one male). The gardeners told me there are three kinds of pistaches here, all with green kernels, but one having a white, one a red, and one a red-and-white streaked skin. The first is considered the best, and from a tree of this kind, said to bear very heavily, was taken most of the grafting wood (12922). Grafting can be done successfully here up to the end of February." (*Kearney.*)

12925. PUNICA GRANATUM. **Pomegranate.**

"Pomegranate cuttings taken from a single bush, said to be a very fine, large, red-fruited one. Here it is propagated by cutting off the vigorous root shoots where they are about a half inch thick and sticking them into the ground so that the main stem is horizontal and is covered with earth, while the stiff, divergent branches stick up vertically. In this way a good-sized bush, bearing well, is obtained in two years." (*Kearney.*)

12926. (Undetermined.)

12927 to 12929. TRIFOLIUM sp. Clover.

From Corfu, Greece. Received thru Mr. C. S. Scofield in 1901. Seeds gathered on the place of Mr. Antonio Colla.

12927. TRIFOLIUM MARITIMUM.

12928. TRIFOLIUM POLYSTACHYUM.

12929. TRIFOLIUM PROCUMBENS.

12930 and 12931. MANGIFERA INDICA. Mango.

From Honolulu, Hawaii. Presented by Mr. G. P. Wilder. Received February 20 and 21, 1905.

12930. *Russet.*

12931. (Not named.)

12932. CARUM GAIRDNERI (?).

From Winslow, Wash. Received thru Mr. John L. Hubbard, March 6, 1905.

"This plant grows thruout eastern Washington, Oregon, and Idaho, and is called by the Indians on the Umatilla Reservation, in eastern Oregon, *Sow-itk.* This plant is similar in foliage to the carrot, is a hardy perennial with a root similar to the sweet potato, and is very pleasant to the taste, either raw or cooked. When it is raw the meat is about the consistency of a raw potato, of a sweet taste; when cooked it becomes mealy, like a baked sweet potato. It was used extensively as a food staple by the Indians thruout the Northwest before the advent of the white people, and is used by them to some extent yet.

"That the plant is susceptible of material development is proven by its being found to grow much larger in plowed fields or cultivated soil, where the roots have not been destroyed by such cultivation. I believe that if your Department would give this matter your attention a new and valuable vegetable would be added to the food products of the country." (*Letter dated January 30, 1905, from Mr. Hubbard.*)

Mr. F. V. Coville, botanist, in a letter dated March 16, 1905, gives the following information: "The plant is widely used for food among the northwestern Indians. The late Major Bendire, of the United States Army, considered it one of the most delicious vegetables he had ever tasted. I shall be very glad, indeed, to see Mr. Oliver take up its culture with a view to its domestication. It would be a vegetable somewhat of the type of the sweet potato. You will be interested to know that, by reason of the summer drought prevalent in the regions where the plant grows, the growing period of the species is short, a fact which will be very advantageous in connection with its proposed domestication."

12933 to 12937. PERSEA GRATISSIMA. Avocado.

From Miami, Fla. Propagated by Prof. P. H. Rolfs, pathologist in charge of Subtropical Laboratory. Numbered February 21, 1905.

12933.

Baldwin. "Tree a vigorous grower, with strong central stem; branches rather rigid; light bloomer, but heavy cropper. Blooms in February and March. Fruit at best in August; drops in September. Ripens uniformly. Shape of fruit approaching oblong, 4 by 5½ inches, not regular; color green, with a few yellowish streaks; rind smooth, thin; stem small; meat deep cream, one-fourth green, firm; flavor excellent. Seeds are rather large, firm in cavity. Buds do not take readily. Named for Mr. Baldwin, of Miami, Fla., who owns the original tree." (*Rolfs.*)

12934.

Chappelow. "Tree grows vigorously; branches diffuse, slender, inclined to droop; bark of young branches shiny, greenish yellow. Good cropper and abundant bloomer. Blooms in January and February; fruit ripens in June and July.

"Shape of fruit, bottle-necked, 2½ by 4½ inches; color dull purple; skin thin, leathery; meat greenish near rind, whitish toward seed; seed medium; firm in cavity; edible qualities good, but different from other type. The buds take readily and the tree stands more cold than other varieties planted. Most useful for home consumption. Named for Mr. William Chappelow, Monrovia, Cal. Buds secured thru Mr. William A. Taylor." (*Rolfs.*)

12933 to 12937—Continued.

12935.

Family. "A strong growing tree of spreading habits, being an abundant bloomer and moderate cropper. Blooms in late February and during March. Ripens fruit during July, August, September, and into October.

"Shape of fruit variable, from pear-shaped to long oblong, nearly banana-shaped; size, variable from 6 by 3½ to 3½ by 1½ inches; color purple, with scarlet streaks, very attractive; skin medium thick, smooth; stem large; meat yellow, free from fiber; flavor good, seed small, loose in cavity.

"The principal merit of this variety lies in extending its period of ripening over so long a time, being distinctly useful for family purposes, but should not be planted for commercial purposes, as the extended ripening period necessitates several pickings. Buds take readily." (*Rolfs.*)

12936.

Pollock. "Tree moderate grower, heavy bearer, profuse bloom, limbs rigid; blooms in February and March; ripens in September and October. Upright grower with strong central stem.

"Fruit pear-shaped, being about 6½ by 4½ inches; weight up to 3½ pounds; color greenish; rind medium; meat yellowish; flavor good; seed medium. Buds take readily, and this variety is desirable on account of very large fruits. Named for Mr. Pollock, of Miami, Fla., who owns the original tree." (*Rolfs.*)

12937.

Trapp. "Tree upright grower with strong central stem; not a vigorous grower. Produces abundant bloom late in February and March. A heavy cropper, maturing in October and November, some of the fruits remaining on the trees until the Christmas holidays.

"Shape of fruit rather between round and oblong, about 4½ by 3½ inches, regular; color greenish with yellowish streaks; thin rind; small stem; meat rather deep yellow; seed variable, sometimes very large and firm in cavity, and again very small and loose in cavity.

"The special merit of this variety lies in the fact that the fruit remains on the tree until late in the season. Named for Mrs. Trapp, Cocoanut Grove, Fla., who owns the original tree." (*Rolfs.*)

12938. GOSSYPIUM sp. **Cotton.**

From Peru, South America. Received thru W. R. Grace & Co., 1 and 2 Hanover square, New York, N. Y., February 13, 1905.

"Full rough" *Catacaos* seed. Represents the seed of the full rough Peruvian cotton, which is grown in the Piura and the surrounding districts in the northern part of Peru.

This "Full rough" cotton is exported to New York and Liverpool markets. There are two crops every year: "San Juan" and "Navidad." The former is largest and is gathered in August to September, while the latter is ready for shipment from the end of January thru April. We would say that the average annual crop was 18,000 bales of 200 pounds.

Many experiments have been made to plant this seed and grow the same grade of cotton in other localities but without success, because soil similar to that of the Piura districts (where it seldom rains) is yet to be found. Every attempt to transplant this grade to any other place in Peru was either a complete failure or the cotton degenerated into "Moderate rough."

12939. ZEA MAYS. **Corn.**

From Montgomery, Ala. Received thru Charles & Nelson, No. 8 Commerce street, February 11, 1905.

Mexican June.

12940 to 12957. VITIS spp. **Grape.**

From Thomery, France. Received thru Etienne Salomon & Sons, February 24, 1905.

12940. *Alicante Bouschet × Riparia 141-A.*

12941. *Berlandieri × Riparia 157-11.*

12940 to 12957—Continued.

12942. *Berlandieri* × *Riparia 420-B.*

12943. *Berlandieri Lafont No. 9.*

12944. *Bourisquou* × *Rupestris 3907.*

12945. *Carignane* × *Rupestris 503.*

12946. *Riparia* × *Rupestris-Aramon-Jaeger 201.*

12947. *Riparia Ramon.*

12948. *Rupestris Mission.*

12949. *Riparia Grand Glabre* × *Aramon-Rupestris 4110.*

12950. *Riparia* × *Cordifolia-Rupestris 106-8.*

12951. *Rupestris* × *Berlandieri 301-37-152.*

12952. *Riparia Colorado.*

12953. *Solonis* × *Riparia 1615.*

12954. *Vialla.*

12955. *Aramon* × *Riparia 143-A.*

12956. *Cinerea-Rupestris* × *Riparia 239.*

12957. *Riparia* × *Rupestris 108-103.*

12958. IPOMOEA sp.

From Cuba. Received thru Prof. P. H. Rolfs, Subtropical Laboratory, Miami, Fla., February 23, 1905.

Seeds of a variety of Ipomœa that is found in Cuba. Said to have yellow flowers.

12959. (Undetermined.) **Matundulaku.**

From Eureka City, Transvaal. Presented by A. T. Metcalf, esq., thru Hon. W. Stanley Hollis, United States consul, Lourenço Marquez, Portuguese East Africa. Received February 23, 1905.

"Evidently a plum-like fruit with a very large stone and little meat." (*Fairchild.*)

12960. GARCINIA LIVINGSTONEI. **Pimbe.**

From Lourenço Marquez, Portuguese East Africa. Presented by Hon. W. Stanley Hollis, United States consul. Received February 23, 1905.

12961. HYDRANGEA SCANDENS.

From Philadelphia, Pa. Received thru Thomas Meehan & Sons, February 23, 1905.

12962. (Undetermined.)

From Lourenço Marquez, Portuguese East Africa. Presented by Hon. W. Stanley Hollis, United States consul. Received February 23, 1905.

A Lourenço Marquez fruit tree.

12963 to 12970.

From Philadelphia, Pa. Received thru W. A. Burpee & Co., February 17, 1905.

Flower seeds for stock purposes.

12971 to 12987.

From New York, N. Y. Received thru J. M. Thorburn & Co., February 17, 1905.

Flower seeds for stock purposes.

12988. ANTIRRHINUM MAJUS. **Snapdragon.**

From Fairfield, Wash. Received thru Mr. E. H. Morrison, January 3, 1905.

12989. COSMOS BIPINNATUS. **Cosmos.**

From Santa Clara, Cal. Received thru C. C. Morse & Co., January 10, 1905.

12990. KOCHIA SCOPARIA.

From Detroit, Mich. Received thru Mr. William McRobbie, gardener of the Palmer Park Gardens, November 7, 1904.

12991. MEDICAGO SATIVA. **Alfalfa.**

From Excelsior, Minn. Received thru Mr. A. B. Lyman, February 24, 1905.

Grimm. A variety attracting attention in the Northwest. (See Bulletin (press), No. 20, University Exp. Sta., St. Anthony Park, Minn., March, 1904, on Hardy Alfalfa in Minnesota.)

12992. MEDICAGO SATIVA. **Alfalfa.**

From Bassorah, Arabia. Secured thru H. P. Chalk, esq., American consular agent. Received February 27, 1905.

"From preliminary tests of this alfalfa, made from a previous importation, under S. P. I. No. 8806, it seems probable that this particular strain will make a more rapid growth than the ordinary varieties cultivated in this country and may prove especially valuable for certain regions in southern California and Arizona. These preliminary experiments have been carried on at the Pomona substation in California, where this variety, together with the ordinary and the Turkestan varieties, planted side by side at the same time, exhibited most unusual rapidity of growth." (*Fairchild.*)

12993. HORDEUM DISTICHUM NUTANS. **Two-row barley.**

From Minneiska, Minn. Received thru Mr. H. L. Whitman, February 23, 1905.

Hanna.

12994. ANEMONE ALPINA SULPHUREA.

From Carsethorn, Dumfries, Scotland. Presented by Mr. Samuel Arnott. Received February 25, 1905.

12995 and 12996. PINGUICULA spp.

From Mexico. Presented by Dr. J. N. Rose. Received February 15, 1905.

12995. PINGUICULA sp. **12996.** PINGUICULA CAUDUTA.

12997. SPREKELIA FORMOSISSIMA.

From Mexico. Presented by Dr. J. N. Rose. Received February 15, 1905.

"This is an old garden favorite, but is especially interesting, as it comes from the high mountains of central Mexico. The home of this species is usually given as South America or Guatemala. Only one species of Sprekelia is recognized by J. G. Baker and other writers on this group, but there are certainly two, if not more, very distinct species. This plant has flowered in Washington several times. The flowers are large, nearly 4 inches long, and deep crimson. It differs only slightly from descriptions. The bulb scales are black, not brown, as usually given. Bulbs were collected in a shallow mountain swamp of central Mexico in 1903 (No. 813)." (*Rose.*)

12998 and 12999. PUNICA GRANATUM. **Pomegranate.**

From Degach (El Oudiane), Tunis. Received thru Mr. T. H. Kearney, March 7, 1905.

12998. *Gabsi.*

A variety having large, pale-red fruit. "The Gabsi is very likely the same 'variety from Gabes,' of which I sent cuttings (S. P. I. No. 12566) in December from Susa." (*Kearney.*)

12999. *Tunisi.*

"A variety smaller than the preceding and having deep-red fruit. Both varieties were obtained at Degach (El Oudiane), the oasis of the Jerid most renowned for its pomegranates, oranges, and olives, while Tozer is celebrated for its figs. These are the two most widely grown kinds here (Tozer). The pomegranates of Gafsa are even more celebrated." (*Kearney.*)

13000. BRASSICA OLERACEA BOTRYTIS. **Cauliflower.**

From Copenhagen, Denmark. Received thru Mr. A. Hansen, seedsman, February 27, 1905.

Dwarf Erfurt.

13001. LYCOPERSICUM ESCULENTUM. **Tomato.**

From Danville, Ky. Received from Mrs. W. B. Thomas, thru Mr. H. Giovannoli, of the United States Treasury Department, March 1, 1905.

Sample of tomato seed grown from seed distributed by the Department of Agriculture in 1891.

13002 to 13006. CITRUS hyb.

From Glen St. Mary, Fla. Propagated by Mr. G. L. Taber, for distribution by the Office of Seed and Plant Introduction and Distribution. Received December 16, 1904.

Hybrid citrus fruits developed by Dr. H. J. Webber, in charge of the Department Plant Breeding Laboratory. Of these hybrids two are called hardy and two are tender. None are true oranges except the two tangerines, *Weshart* and *Trimble*. The hardy varieties constitute a new group designated by Doctor Webber as citranges. They are the *Rusk* and the *Willits*.

The fifth of the lot is a representative of a new group called the "tangelo," being a hybrid between the tangerine and the pomelo. The variety has been called the *Sampson*.

Doctor Webber describes the varieties as follows:

13002.

The *Rusk* citrange (P. B. No. 716) is a hybrid between the common sweet orange (female parent) and the trifoliate orange (male parent). The tree resembles that of the trifoliate orange in character, having trifoliate leaves which are much larger than those of the ordinary trifoliate. It is very productive and bears a small fruit about 2 to 2½ inches in diameter, which is somewhat similar to the tangerine. The fruit is nearly seedless, having only one seed to two fruits, and is very juicy, yielding a much larger quantity of juice than the best lemons of the same size. It makes a very pleasant citrangeade, and can be used for making pies, marmalades, jellies, and for other culinary purposes. Eaten with sugar, it is a very desirable breakfast fruit.

13003.

The *Willits* citrange (P. B. No. 777) is a hybrid between the trifoliate orange (female parent) and the common sweet orange (male parent), being thus the reciprocal hybrid of the *Rusk* citrange. The tree, as in the case of the *Rusk*, is similar to the trifoliate, but with much larger leaves, and it is semi-evergreen. The fruit is nearly seedless, having an average of only one seed to about four fruits. The fruit is slightly larger than the *Rusk*, the largest being about 2½ inches in diameter. The pulp is of a different color from the *Rusk*, being a lemon yellow. The flavor is also much more acid. The fruit is valuable for making citrangeade, pies, marmalades, jellies, and for other culinary purposes. It is too acid to be eaten out of hand.

13004.

This is one of our new hybrid citrus fruits, produced by crossing the tangerine and pomelo. The fruit differs from either parent, but combines the qualities of both. Differing from any other type of citrus fruit, it has been referred to a new group termed the "tangelo" group, and this particular variety has been designated the *Sampson*. The "Sampson tangelo" (P. B. No. 1316) forms a tree resembling in all essential characters the ordinary orange, and is as easily injured by cold. The fruit is about the size of the navel orange but of lighter color, being intermediate in size and color between the tangerine and pomelo. The flavor is sprightly acid, like the grapefruit, but with a slight suggestion of the bitter of that fruit. A striking and highly desirable characteristic is its easily removable rind, derived from the tangerine parent, so that it might be called a "kid-glove" pomelo. It is a tender tree and adapted to distribution in the present citrus-growing regions of Florida and California.

13002 to 13006—Continued.

13005 and 13006. *New tangerine oranges.*

No. 13005 (P. B. No. 628) has been named the *Weshart*, and No. 13006 (P. B. No. 627) has been named the *Trimble.*

A large number of hybrids have been made in the course of the investigations between the tangerine and various varieties of the sweet orange, with the object of producing an orange having the quality and character of the sweet orange with the loose, easily removable rind of the tangerine. Among the different hybrids which have thus far fruited, two have produced fruits which in all respects resemble true tangerines but are two weeks earlier than the earliest tangerines, and are larger, richer in color, and of rather superior quality.

13007 to 13026.

From Philadelphia, Pa. Received thru Henry A. Dreer (Incorporated), February 28, 1905.

A collection of flower seeds to be grown for stock.

13027 to 13034. SOLANUM TUBEROSUM. **Potato.**

From Auchtermuchty, Scotland. Received thru Prof. L. R. Jones, of the Vermont Experiment Station, March 3, 1905.

A collection of European potatoes for breeding purposes, as follows:

13027.

British Queen. (L. R. Jones's No. 43.) Originated by Findlay. Second early; white skin and flesh; kidney; quality reputed excellent and yield good. "Best second early in cultivation in England to-day," according to one high authority. Mr. Findlay claims that it is highly disease resisting, but others do not so consider it. Especially commended for trial in Florida, etc.

13028.

Royal Kidney. (L. R. Jones's No. 44.) Originated by Findlay, 1901. Late second early; white; quality excellent; yield good. Mr. Findlay claims this to be one of the hardiest disease-resisting varieties he has sent out. Commended for trial both in the North and South, as well as in Colorado.

13029.

Empire Kidney. (L. R. Jones's No. 45.) One of Findlay's recent varieties, and especially recommended by him as disease resisting and worthy of trial. Heavy yielder; good quality; said to be best on fertile loam. Selected especially for trial in the North and West, rather than in the South.

13030.

Evergood. (L. R. Jones's No. 46.) Originated and sent out by Findlay, about 1899. Medium late; white; oval; high quality; heavy cropper. Characterized by prolonged autumnal growth if the season favors. Commended by Mr. Findlay and others as disease resisting. Selected especially for trial in the North and West.

13031.

Goodfellow. (L. R. Jones's No. 47.) Originated by Mr. Findlay. Medium late; white skin and flesh; round; quality fine; yield good. Characterized by Mr. Findlay and others as disease resisting. Selected especially for trial in the North and West.

13032.

Up-to-Date. (L. R. Jones's No. 48.) One of Findlay's varieties sent out many years ago and now one of the standard main crop varieties of England. Commended as still in a fair degree disease resisting, altho past its prime in this respect. Medium late; white; excellent quality; strong yielder. Commended especially for trial in the North and West.

13027 to 13034—Continued.

13033.

Northern Star. (L. R. Jones's No. 49.) Medium late; white; round; quality and yield reputed excellent. One of Mr. Findlay's most promising recent introductions (first sent out in 1902). He says "the most disease-resisting potato I have ever known." Some others who have tried it are less optimistic as to this. Commended especially for trial in the North and West.

13034.

Eldorado. (L. R. Jones's No. 50.) Findlay's introduction (1903), and the most advertised potato in England to-day. Sold last year at rate of £200 sterling per pound weight. Medium late; white; elongated oval. Reputed of high quality and yield. Commended most highly by Mr. Findlay as disease resisting, but some others who have watched it are less hopeful of any remarkable characteristics in this direction.

13035 to 13076. ORYZA SATIVA. **Rice.**

From Formosa. Presented by the Agricultural Department of the Formosan Government, thru Mr. Fred. Fisher, United States consul at Tamsui, Formosa. Received March 2, 1905.

The first 20 numbers of this collection are "first crop" and the remainder are "second-crop" samples.

13035. *Chieng Yu.*

From Kirai Sho, Kokansho Seichuri, Ako Prefecture. Clayish soil.

13036. *Pei Cham.*

From Shinsho Shisho, Daichikuri, Hozan Prefecture. Sandy clay soil.

13037. *Chieng Yu.*

From Saikosho, Koryngairi, Hozan Prefecture. Sandy clay soil.

13038. *O Kaku.*

From Ryosan jusho, Rankoho, Taichu Prefecture. Sandy soil.

13039. *Tso Toa Hoe.*

From Sankaitsusho, Emmukabo, Shoka Prefecture. Sandy soil.

13040. *O Kaku.*

From Eibansho Kochokuho, Taihoku Prefecture. Clayish soil.

13041. *Kuai Kau Otowa.*

From Gynhosho, Chikuhoku Itsupo, Shinchiku Prefecture. Sandy soil.

13042. *Pei Bei Fun.*

From Dorawan Sho, Bioritsu Prefecture. Sandy soil.

13043. *Sam Sai.*

From Shinsho, Hokutoho, Nanto Prefecture. Sandy soil.

13044. *O Cham Ko.*

From Tosei Kosho, Dabyo Nanho, Kagi Prefecture. Sandy soil.

13045. *Pa Tei Don.*

From Chuhosho Kagi Toho, Kagi Prefecture. Clayish soil.

13046. *Nun Key.*

From Chinshi, Manrikisho, Enzanho, Gilan Prefecture. Sandy soil.

13047. *An Ka Tsu.*

From Saikosho, Koryugairi, Hozan Prefecture. Sandy clay.

13048. *Pei Gya Nun.*

From Ryo Sanjusho, Rankoho, Taichu Prefecture. Sandy soil.

13035 to 13076—Continued.

13049. *Check Shey.*

From Kokasho Shiran Sampo, Taihoku Prefecture. Lavitic mixt with clayish soil.

13050. *Jippon Tsu.*

From Gynhoshu, Chikuho, Itsupo, Shinchiku Prefecture. Sandy soil.

13051. *Ban Hoe.*

From Lanrisho, Bioritsu Niho, Bioritsu Prefecture. Sandy soil.

13052. *Pei.*

From Horishagai, Horishaho, Nanto Prefecture. Clayish soil.

13053. *Ran Hoe Tsu.*

From Shanshi Kyakusho, Dabyo Nanho. Kagi Prefecture. Sand and loam.

13054. *Ban Hoe.*

From Iketsusho, Shiiho, Gilan Prefecture. Clayish soil.

13055. *Tsu Pian.*

From Kaihosho, Seichuri, Akoku, Ako Prefecture. Sandy soil.

13056. *Pa Chiam.*

From Shintosen Sho, Seikari, Hozan Tsuku, Hozan Prefecture. Sandy soil.

13057. *O Kaku.*

From Gokosho, Daichikuri, Hozan Prefecture. Sandy clay.

13058. *Pei Kaku.*

From Hyoshitoyo Daimokukori, Tainan Prefecture. Sandy soil.

13059. *Go Ki Tsoa.*

From Horishagai, Horishoho, Nanto Prefecture. Clayish soil.

13060. *O Kaku.*

From Nantogai, Nantoho, Nanto Prefecture. Clayish soil.

13061. *U Kyo.*

From Nantogai, Nantoho, Nanto Prefecture. Clayish soil.

13062. *Shun Tsui Ban.*

From Sotosho, Hokutoho, Nanto Prefecture. Clayish soil.

13063. *Shi Kin Tsai.*

From Shikyotosho, Shushuho, Nanto Prefecture. Clayish soil.

13064. *Chino.*

From Shikyotosho, Shushuho, Nanto Prefecture. Clayish soil.

13065. *O Ka Hoe Rai.*

From Dakusuisho, Sarenkaho, Nanto Prefecture. Clayish soil.

13066. *Ban Na.*

From Shinsho, Hokutoho, Nanto Prefecture. Clayish soil.

13067. *Chien Yu.*

From Shinkogai, Siiho, Kagi Prefecture. Clayish soil.

13068. *O Kau.*

From Chuhosho, Kagiho, Kagi Prefecture. Clayish soil.

13069. *Toa Tsu.*

From Boryo, Boryosho, Tokari, Ako Prefecture. Loamy soil.

13070. *Toa Tsu.*

From Shinsho Shisho, Daichikuri, Hozan Prefecture. Sandy clay soil.

13035 to 13076—Continued.

13071. *Pei Tsu.*

From Gokosho, Daichikuri, Hozan Prefecture. Sandy clay soil.

13072. *Cha Ah Tsu.*

From Sankai Tsusho, Emmukaho, Shoka Prefecture. Sandy soil.

13073. *Tao Ro.*

From Shojibokuko, Naisho Shisho, Gai Shinka Nanri, Tainan Prefectur Clayish soil.

13074. *Hon Hoe.*

From Nairokusho, Nantoho, Nanto Prefecture. Clayish soil.

13075. *Gya Loon.*

From Nairokusho, Nantoho, Nanto Prefecture. Clayish soil.

13076. *Pei Tsu.*

From Kobo Suido, Dabyo Nanho, Kagi Prefecture. Sandy soil.

NOTE.—In the above list, Nos. 13035 to 13046 and 13055 to 13068 were marke "*Oryza utilissima*," while Nos. 13047 to 13054 and 13069 to 13076 were labele "*Oryza glutinosa*."

13077. KOCHIA SCOPARIA.

From Takoma Park, D. C. Grown by Mr. A. J. Pieters during the season of 190 for stock purposes.

13078. AGARICUS sp. **Mushroom**

From Tokyo, Japan. Received thru Mr. T. Watase, president of the Toky Plant, Seed, and Implement Company, March 7, 1905.

"*Shiitake.*" "Spawn of the edible species of Japanese mushroom, which is cultivate on an immense scale in the forests of Japan. It is a tree-inhabiting fungus and th Japanese have developed a special system of culture by means of which they ca produce immense quantities at little expense. This spawn was introduced especiall for the experiments of Dr. B. M. Duggar, of the Agricultural Experiment Station Columbia, Mo., and is well worth calling to the attention of the mushroom grower of America, who should be given a chance to test this in comparison with the ordinary *A. campestris*, which is grown almost exclusively on beds of manure. T variety of Agaricus is keenly relished, not only by Japanese but by Europeans living in Japan." (*Fairchild.*)

13079. GOSSYPIUM sp. **Cotton.**

From Lourenço Marquez, East Africa. Presented by Hon. W. Stanley Hollis, United States consul. Received March 3, 1905.

"From the slopes of the Lebombo Mountains, in the district of Lourenço Marquez." (*Hollis.*)

13080 to 13083. IPOMOEA HEDERACEA. **Japanese morning-glory.**

From Yokohama, Japan. Received thru the Yokohama Nursery Company, March 6, 1805.

13080. Common single.

13081. Double.

13082. Giant.

13083. Single fringed.

13084. SECHIUM EDULE. **Chayote.**

From Mayaguez, P. R. Received thru Mr. O. W. Barrett, of the Agricultural Experiment Station, March 8, 1905.

Fruits secured from Mr. S. van L. Lippitt, of Mayaguez, P. R.

13085. XANTHOSOMA SAGITTIFOLIUM. **Yautia.**

From Mayaguez, P. R. Received thru Mr. O. W. Barrett, of the Agricultural Experiment Station, February 27, 1905.

Rolliza. Tubers of the native Porto Rican Yautia "No. 1," from selected plants howing no sign of any fungous disease and growing in new soil. (For description, ee No. 15417.)

13086. COLOCASIA sp. **Taro.**

From Mayaguez, P. R. Received thru Mr. O. W. Barrett, of the Agricultural Experiment Station, February 27, 1905.

Tubers of the *Dasheen* Colocasia from Trinidad, British West Indies. (For description, see No. 15395.)

13087. PYRUS MALUS. **Apple.**

From Amassia, Asia Minor. Presented by Mr. H. Caramanian. Received March 11, 1905.

Misket. "We found it to be a sweet apple of very firm texture and of rather ordiary quality. We do not consider it equal in quality to such varieties as *Lady Sweet*, *Vinter Paradise*, *Victoria*, *Green Sweet*, or *Tolman*. It may have value for warm limates, however, and on this account I think it would be well to place scions of it r fruiting as quickly as possible by top-working on bearing trees at some represent-tive southern points." (*W. A. Taylor.*)

13088. ALLIUM CEPA. **Onion.**

From Santa Clara, Cal. Received thru C. C. Morse & Co., March 15, 1905.

Grown from S. P. I. No. 9318.

3089. RHEUM OFFICINALE. **Rhubarb.**

From Paris, France. Received thru Vilmorin-Andrieux & Co., March 15, 1905.

3090. AVENA SATIVA. **Oat.**

From Lincoln, Nebr. Received thru Prof. T. L. Lyon, Agricultural Experiment Station, March 10, 1905.

Kherson.

13091. AVENA SATIVA. **Oat.**

From Brandon, Wis. Received thru Mr. F. E. Jones, March 16, 1905.

Swedish Select. Grown from S. P. I. No. 2788. In the spring of 1899 Mr. David ones, Brandon, Wis., planted an ounce of No. 2788. Thirty-two seeds grew, and rom this little plot he and his neighbors raised 200,000 bushels of oats in 1904.

13092. AGROPYRON TENERUM. **Slender wheat-grass.**

From Brandon, Manitoba. Received thru A. E. McKenzie & Co., March 16, 1905.

13093. RHEUM PALMATUM TANGHUITICUM. **Rhubarb.**

From Paris, France. Received thru Messrs. Vilmorin-Andrieux & Co., March 17, 1905.

13094. GOSSYPIUM HIRSUTUM. **Cotton.**

From Guatemala. Received thru Mr. O. F. Cook, March 17, 1905.

Rabinal. "Cultivated by the Quiche Indians of Rabinal and other neighboring laces of the dry plateau region of central Guatemala. A variety of the Upland ype, grown as an annual crop, tho really a perennial. The stalks are cut back to the ground every year. The new shoots set flowers and fruit with great promptness, which, with the assistance of the native turkeys, enable a crop to be secured in spite of the presence of the boll weevil.

"This variety may be of interest in southern and southwestern Texas, either as a perennial or an annual. Even in the first year it is likely to be an early-maturing sort." (*Cook.*) (No. 1.)

13095. GOSSYPIUM HIRSUTUM. **Cotton.**

From Guatemala. Received thru Mr. O. F. Cook, March 17, 1905.

Kekchi. "Grown by the Indians at Secanquim, Cajabon district, Alta Vera Paz, Guatemala, the original locality of the weevil-eating keleps. This variety is of dwarf habit. It begins fruiting while still very young, and matures a crop in six months even in a humid tropical climate where other kinds of cotton would probably require a much longer time. It is expected that in the United States this will prove to be an extra-early variety, tho two or three years of acclimatization may be required. Of the varieties now in the United States the *Kekchi* cotton most nearly resembles the *King*, but it seems to possess the desirable qualities of that variety to an even greater degree and the lint is longer and of better quality." (*Cook.*) (No. 2.)

13096. GOSSYPIUM HIRSUTUM. **Cotton.**

From the market of Coban, Alta Vera Paz, Guatemala. Received thru Mr. O. F. Cook, March 17, 1905.

"Supposed to have been grown in the valley of the Polochic River. Probably similar to the *Kekchi* cotton, tho the Indians belong to another tribe." (*Cook.*) (No. 3.)

13097. GOSSYPIUM HIRSUTUM. **Cotton.**

From Retalhuleu, Guatemala. Received thru Mr. W. R. Maxon, March 17, 1905.

Pachon. "The variety most extensively grown in the western part of Guatemala, where a considerable cotton industry exists. Mr. Maxon was informed that this variety was originally introduced into Guatemala from Peru, but an examination of specimens shows that it is an Upland form similar to the *Kekchi* cotton and with the same weevil-resisting adaptations. It is said to mature a crop in five months." (*Cook.*) (No. 4.)

13098. GOSSYPIUM HIRSUTUM. **Cotton.**

From Retalhuleu, Guatemala. Received thru Mr. W. R. Maxon, March 17, 1905.

Ixcacco. "A brown cotton of the Upland type, similar to the brown form of the *Kekchi* cotton. The cotton brings the same price as the *Pachon* and is thought to have a stronger lint." (*Maxon.*) (No. 5.)

13099. GOSSYPIUM HIRSUTUM. **Cotton.**

From Retalhuleu, Guatemala. Received thru Mr. W. R. Maxon, March 17, 1905.

"Seeds of a supposed hybrid between *Pachon* and *Ixcacco* cotton. A single boll of this type was found on a plant the other bolls of which were white and apparently pure *Pachon.*" (*Maxon.*) (No. 6.)

13100. GOSSYPIUM HIRSUTUM. **Cotton.**

From Retalhuleu, Guatemala. Received thru Mr. W. R. Maxon, March 17, 1905.

"A smooth-seeded variation of *Pachon* cotton said to occur sporadically in the fields of the hairy-seeded form. The fiber is said to be not quite so long as the regular *Pachon.* This form is popularly believed to be that originally cultivated by the Indians in this locality." (*Maxon.*) (No. 7.)

13101. GOSSYPIUM HIRSUTUM. **Cotton.**

From Cucanha, near Tucura, Guatemala. Received thru Mr. O. F. Cook, March 17, 1905.

"A cotton similar to *Kekchi* grown in the valley of Polochic River." (*Cook.*) (No. 8.)

13102. MESEMBRYANTHEMUM GEMINATUM (?).

From Sfax, Tunis. Received thru Mr. T. H. Kearney, March 17, 1905.

"Cuttings of a variety of Mesembryanthemum that is used for making lawns on land that is so alkaline that deposits of white alkali may be seen beneath the mat of the plant. I believe this will be valuable as a cover for alkaline soils." (*Fairchild.*)

13103. CARICA PAPAYA. **Papaw.**

From Esmeraldas, Ecuador. Presented by Mr. George D. Hedian. Received March 16, 1905.

13104. ALEURITES CORDATA. **Tung-shu or wood-oil tree.**

From Hankow, China. Presented by Consul-General L. S. Wilcox and received at Chico, Cal., March 18, 1905.

"The fruit of this tree is the source of "wood oil," which is being imported in large quantities by this country, where it is used in the manufacture of paints, fine varnishes, and soaps. The tree itself is of stately appearance, with green, smooth bark and spreading branches, making it one of the finest of shade trees. It has been styled, and worthily so, "the national tree of China." The Tung-shu flourishes thruout the Yangtze Valley in latitude 25° to 34° N. It is said not to bear when subjected to temperatures as low as 20° F., altho it will stand any degree of heat. The trees are raised from seed in a bed and transplanted when about a foot high, and seem to do well in almost any kind of soil. The Tung-shu is also propagated by cuttings. It is a rapid grower and will come into bearing in from three to six years, much depending upon the fertility of the soil. The yield of nuts from an average tree may be put at anywhere from 20 to 50 pounds, while the percentage of oil obtained from the nut is 40 per cent. The Chinese find a great many other uses for the oil of this tree; also for its wood and the refuse from the wood oil nut after extraction of the oil. Persons growing the wood oil tree should be cautioned against allowing the oil to come in contact with the skin, as it is extremely poisonous." (*Wilcox.*)

13105. SOLANUM COMMERSONI. **Aquatic potato.**

From Burlington, Vt. Presented by Prof. William Stuart, Agricultural Experiment Station, thru Mr. W. A. Orton. Received March 21, 1905.

13106. LILIUM hyb. **Lily.**

Seedlings resulting from pollinating flowers of *Lilium longiflorum eximium giganteum* (S. P. I. No. 11583) with *Lilium harrisii*. Crossing done by Mr. G. W. Oliver in the Department greenhouse during 1904.

13107. PAPAVER SOMNIFERUM. **Poppy.**

From Philadelphia, Pa. Received thru Powers, Weightman & Rosengarter, March 21, 1905.

Opium seed from Asia Minor.

13108 to 13115. ROSA hyb. **Rose.**

From Sawbridgeworth, Herts, England. Received thru Thomas Rivers & Son, The Nurseries, March 23, 1905.

13108. *Conrad F. Meyer.*
13109. *Fimbriata.*
13110. *Mrs. Anthony Waterer.*
13111. *Rose Apples.*
13112. *Souv. de Christophe Cochet.*
13113. *Blanche de Coubert.*
13114. *Thusnelda.*
13115. *Repens Alba.*

13116 to 13129. Rosa hyb. **Rose.**

From Herts, England. Received from William Paul & Son, Waltham Cross, March 23, 1905.

13116. *Etoile de France.*
13117. *Countess Cairns.*
13118. *Earl of Warwick.*
13119. *Irene.*
13120. *Mrs. A. Byass.*
13121. *America.*
13122. *Atropurpurea.*
13123. *Belle Poitevine.*
13124. *Blanc Double de Coubert.*
13125. *Calocarpa.*
13126. *Chedane Guinoisseau.*
13127. *Mercedes.*
13128. *New Century.*
13129. *Rugosa Regliana.*

13130 and 13131. Castanea spp. **Chestnut.**

Received from Mr. T. E. Steele, Palmyra, N. Y., March 24, 1905.

13130. Castania crenata. Seedling Japanese chestnut.

13131. Castania sativa. Seedling Spanish chestnut.

13132. (Undetermined.) **Matondo.**

From Melsetter, Rhodesia, South Africa. Presented by Mr. W. M. Longden. Received March 23, 1905.

A fruit by the name of "Matondo," described by Mr. Longden as follows: "The tree is a large, evergreen one, casting a dense shade. It grows to a height of about 60 feet, has a spreading habit, and is a prolific bearer. Fruit oval in shape, with a smooth skin and faint veins; color when ripe, yellow; dark green when unripe. Size up to 3 inches by 2 inches in diameter. Peel tough and thick, not edible; exudes milky fluid, very bitter and distasteful. Flesh edible, jelly-like in appearance, sweet and pleasant to taste. It grows in the Sabi Valley principally, at an altitude of about 1,800 feet, where the climate is very warm and there is comparatively no frost."

"This fruit should be experimented with in Porto Rico, Hawaii, and southern California." (*Fairchild.*)

13133. Vitis sp. **Grape.**

From Algeria, North Africa. Presented by Dr. L. Trabut and forwarded by Mr. T. H. Kearney. Received March 27, 1905.

Boufarik (table). A desert-resistant grape.

13134. Agaricus sp. (?) **Mushroom.**

From Yokohama, Japan. Received thru Yokohama Nursery Company, March 27, 1905.

13135. Garcinia mangostana. **Mangosteen.**

From Buitenzorg, Java. Received thru Doctor Treub, March 24, 1905

13136 to 13142.

From Melsetter, Rhodesia, South Africa. Presented by Mr. W. M. Longden. Received March 27, 1905.

A collection of fruit trees, with descriptions by Mr. Longden, as follows:

13136. (Undetermined.) **Ivory nut.**

"It (the nut) grows on a palm tree, which sometimes reaches a height of 60 feet. The natives eat the spongy substance between the skin and kernel. The vegetable ivory is, I think, an article of commerce."

13136 to 13142—Continued.

13137. ANONA sp. **Custard-apple.**

"Edible. Tree very much resembles the domestic variety; fruit has a delightful flavor."

13138. FICUS sp. **Fig.**

"Edible. Grows on the river banks. These have a sweet flavor. There is also another variety larger, perhaps, than any domestic fig. They are comparatively flavorless."

13139. (Undetermined.) **"Wild plum."**

"Edible. Tree very similar to your persimmon. Natives also eat the kernel, which has a nutty flavor with a touch of almond, and contains a large percentage of oil, which the natives extract."

13140. EUPHORBIA sp. (?). **"Footah."**

"Fruit is used by the natives for making a pleasant drink by soaking the ripe seeds in water, which turns milky when stirred. Seeds are also crusht for oil, of which they contain a large quantity. Tree grows to a height of about 50 feet; dense, shiny, dark-green foliage giving immense shade."

13141. (Undetermined.) **"Mutwzwa."**

"Edible. Flavor somewhat similar to damson. Grows in stony ground; bush about 7 feet in height."

13142. (Undetermined.) **"Eecha."**

"Species of nut. May be eaten raw, but is usually roasted by the natives. It is only to supplement food supplies in lean years."

13143 to 13153. ZEA MAYS. **Sweet corn.**

First generation from S. P. I. Nos. 12557 and 12558. Distributed during the season of 1905 for further trial to test the effects of soil, location, etc.

13143 to 13147. *Stowell's Evergreen.* Grown from S. P. I. No. 12557.

13143. Received from Prof. J. C. Whitten, Columbia, Mo., February, 1905.

13144. Received from Mr. J. C. Robinson, Waterloo, Nebr., February, 1905.

13145. Received from Prof. R. A. Emerson, Lincoln, Nebr., February, 1905.

13146. Grown on the Arlington Farm during the summer of 1904.

13147. Received from A. Mitchelson & Son, Tariffville, Conn., February, 1905.

13148 to 13153. *Early Crosby.* Grown from S. P. I. No. 12558.

13148. Received from Prof. C. P. Ball, Minneapolis, Minn., February, 1905.

13149. Received from Prof. R. A. Emerson, Lincoln, Nebr., February, 1905.

13150. Received from A. Mitchelson & Son, Tariffville, Conn., February, 1905.

13151. Received from Mr. J. C. Robinson, Waterloo, Nebr., February, 1905.

13152. Received from Prof. J. C. Whitten, Columbia, Mo., February, 1905.

13153. Grown on the Arlington Farm during the summer of 1904.

13154. PISTACIA sp. **Pistache.**

From Aintab, Turkey. Presented by Rev. A. Fuller thru Mr. Walter T. Swingle. Received March 27, 1905.

13155. RHUS COPALLINA. **Sumac.**

From Austin, Tex. Presented by Mr. F. T. Ramsey. Received March 27, 1905.

13156 to 13158.

From Amassia, Turkey. Presented by Mr. H. Caramanian. Received March 29, 1905.

13156. PYRUS MALUS. **Apple.**

13157. PRUNUS DOMESTICA. **Plum.**

Uryäny. (See S. P. I. No. 10526.)

13158. CYDONIA sp. **Quince.**

Adjem.

13159 to 13236. IRIDACEAE.

From Yokohama, Japan. Received thru Suzuki & Iida, New York, N. Y., March 25, 1905.

13159 to 13226. IRIS KAEMPFERI. **Iris.**

13159. *Gekka-no-nami.*
13160. *Shishi-odori.*
13161. *Kumoma-no-sora.*
13162. *Kumo-no-obi.*
13163. *Ho-o-jo.*
13164. *Gei-sho-ui.*
13165. *Sofu-no-koi.*
13166. *Manadsuru.*
13167. *Hana-no-nishiki.*
13168. *Yomo-no-umi.*
13169. *Meiran.*
13170. *Kuma-funjin.*
13171. *Taiheiraku.*
13172. *Hana-aoi.*
13173. *Uchiu.*
13174. *Osho-kun.*
13175. *Shippo.*
13176. *Kumo-isho.*
13177. *Kiji-no-megumi.*
13178. *Kumo-no-uye.*
13179. *Yezo-nishiki.*
13180. *Shishi-ikari.*
13181. *Oniga-shima.*
13182. *Sano-watashi.*
13183. *Yedo-jiman.*
13184. *Senjo-no-hora.*
13185. *O-torige.*
13186. *Shirataki.*
13187. *Shiga-no-uranami.*
13188. *Kagaribi.*
13189. *Kosui-no-iro.*
13190. *Komochi-guma.*
13191. *Kakujakuro.*
13192. *Momiji-no-taki.*
13193. *Shichiukwa.*
13194. *Yedo-kagami.*
13195. *Uji-no-hotaru.*
13196. *Shimoyo-no-tanki.*
13197. *Tsurugi-no-mai.*
13198. *Iso-no-nami.*
13199. *Oyodo.*
13200. *Bandai-no-nami.*
13201. *Wakamurasaki.*
13202. *Kyodaisan.*
13203. *Kigan-no-misao.*
13204. *Koki-no-iro.*
13205. *Samidare.*
13206. *Tora odori.*
13207. *Tsuru-no-kegoromo.*
13208. *Datedogu.*
13209. *Ayase-gawa.*
13210. *Ho-dai.*
13211. *Nishiki-hitone.*
13212. *Riubi.*
13213. *Renjo-no-tama.*
13214. *Yomo-zakura.*
13215. *Shiye-no-yuki.*
13216. *Asa-kagura.*
13217. *Sumida-gawa.*

13159 to 13236—Continued.

13159 to 13226—Continued.

13218. *Tsutsu-izutsu.*

13219. *Rinpo.*

13220. *Chitose-dsuru.*

13221. *Risho-no-tama.*

13222. *Kasu-gano.*

13223. *Asa-gasumi.*

13224. *Fuki-yose.*

13225. *Goko-no-asobi.*

13226. *Yamato-zukusa.*

13227 to 13235. Iris spp. **Iris.**

13227. Iris albo-purpurea.

13228. Iris albo-purpurea.

13229. Iris raphiolepis.

13230. Iris raphiolepis variegata.

13231. Iris gracilipes.

13232. Iris sibirica.

13233. Iris laevigata.

13234. Iris laevigata semperflorens.

13235. Iris laevigata alba.

13236. Belamcanda punctata.

13237. Medicago sativa. **Alfalfa.**

From Chinook, Mont. Received thru the Thomas O'Hanlon Company, March 30, 1905. Grown by George Davidson, near Chinook, in Milk River Valley, under irrigation.

13238 to 13240.

From Lourenço Marquez, Portuguese East Africa. Presented by Hon. W. Stanley Hollis, United States consul. Received March 27, 1905.

13238. Gossypium sp. **Cotton.**

"Native East African cotton seed, which was got for me from the slopes of the Lebombo Mountains by the Bishop of Lebombo." (*Hollis.*)

13239. Carissa arduina. **Amatungulu.**

"The 'Martingula,' which is highly esteemed here for eating fresh, as well as for making preserves." (*Hollis.*)

13240. (Undetermined.)

"I have to report that William F. Upshur, esq., of Barrene, Inhambane, has been good enough to furnish me with a small quantity of specimens of a new tree oil seed that is being exploited in the Inhambane district. In Inhambane these oil seeds are called 'Maferera'; in Mozambique, where they grow wild in great profusion, they are called 'Umtizi'; and in Lourenço Marquez, where they are eaten by the natives, they are called 'Umgushu.'" (*Hollis.*)

13241. Ulex europaeus. **Gorse, whin, or furze.**

From Dublin, Ireland. Received thru Hogg & Robertson, March 29, 1905.

13242. Cotoneaster angustifolia.

From Orleans, France. Received thru M. Léon Chénault, Route d'Olivet, 79, March 27, 1905.

13243 to 13255. Rosa sp. **Rose.**

From Worcester, England. Received thru Richard Smith & Co., March 30, 1905.

13243. *Madam George Bruant.*

13244. *Rugosa Alba.*

13245. *Rugosa, fl. pl.*

13246. *Madam Charles Worth.*

13247. *Rugosa Compte D'Empresnel.*

13243 to 13255—Continued.

13248. *Rugosa Rosea.*
13249. *Rugosa Rubra.*
13250. *Austrian Copper.*
13251. *Austrian Yellow.*
13252. *Harisoni.*
13253. *Persian Yellow.*
13254. *Souv. de Pierre Notting.*
13255. *Marechal Niel.*

13256. Zea mays. **Corn.**

From North Pomfret, Vt. Received thru Mr. S. Hewitt, February, 1905.

Malakof. Grown from S. P. I. Nos. 12562 and 12563.

13257. Olea europaea. **Olive.**

From Mustapha, Algeria, North Africa. Presented by Dr. L. Trabut. Received March 30, 1905.

Grosse Aberkan. Cuttings.

13258. Nephelium lappaceum. **Rambutan.**

From Buitenzorg, Java. Presented by Doctor Treub. Received March 31, 1905.

13259. Medicago sativa. **Alfalfa.**

From Milburn, Nebr. Received thru Mr. C. A. Snyder, April 1, 1905.

Seed grown in 1904 on Sec. 13, T. 20, R. 21, Custer County, Nebr., without irrigation, where it is 240 feet to water.

13260 to 13262. Zea mays. **Rice popcorn.**

From Sao Paulo, Brazil. Presented by Prof. A. Lofgren, Horto Botanico. Received March 25, 1905.

13260. *White.*
13261. *Amber.*
13262. *Red.*

13263 to 13265.

From Yokohama, Japan. Received thru Yokohama Nursery Company, April 3, 1905.

13263. Citrus sp. **Orange.**

Natsu daidai. (See S. P. I. No. 8903.)

13264. Juncus effusus. **Matting rush.**

13265. Scirpus triqueter.

13266 to 13285.

From Sultepec, Mexico. Presented by Mr. Federico Chisolm, Hacienda "Cabajal." Received March 28, 1905.

A collection of unidentified plants.

13286 to 13290.

From Philadelphia, Pa. Received thru Henry A. Dreer, Incorporated, April 3, 1905.

Flower seeds for growing seed.

13291. Medicago sativa. **Alfalfa.**

From Fayetteville, N. Y. Received thru Mr. F. E. Dawley, April 1, 1905.

13292. PERSEA GRATISSIMA. **Avocado.**

From Coban, Guatemala. Received thru Mr. G. N. Collins and Mr. C. B. Doyle, March, 1905.

"This thick-skinned type of avocado is very distinct from the varieties commonly found on the markets and from those grown in Florida, the West Indies, and Mexico. It is believed that they will stand shipping much better than the thinner-skinned sorts, and as the quality is fine they should be a valuable acquisition for Porto Rico and Hawaii." (*Collins.*)

13293 to 13297. CALADIUM ESCULENTUM. **Taro.**

From Magnolia, N. C. Received thru the Newberry Bulb Company, March 30, 1905.

13298. PUNICA GRANATUM. **Pomegranate.**

Received March 29, 1905, without advices, thru the Georgetown custom-house. Arrived in New York via steamship *Umbria.*

13299. STUARTIA PENTAGYNA.

From Morrisville, Pa. Received thru Mr. S. C. Moon, April 4, 1905.

13300 to 13303. PHALARIS CANARIENSIS. **Canary grass.**

From Marseille, France. Received thru Hon. Robert P. Skinner, United States consul-general, April 5, 1904.

13300. Cleaned seed from Rodosto, Turkey.

13301. Cleaned seed from Plata, Argentina.

13302. Ordinary seed from Rodosto, Turkey.

13303. Ordinary seed from Plata, Argentina.

"The exporters of canary seed (*Phalaris canariensis*) of Marseille handle only the imported grades, the best of which reach this city from Rodosto (Turkey). The Rodosto seed is richest and has scarcely any grain. The Plata seed has at times a better aspect than the Rodosto seed, but is much lighter, contains straw in excessive quantities, and the kernels are generally decorticated." (*Skinner.*)

13304 and 13305.

From Mustapha, Algeria. Presented by Dr. L. Trabut, government botanist. Received April 7, 1905.

13304. SAPINDUS UTILIS. **Soapberry.**

13305. NARCISSUS PACHYBOLBUS. **Narcissus.**

A vigorous species from western Algeria and Morocco, having 40 or 50 small flowers in clusters. Doctor Trabut thinks this will be interesting to cross with large-flowered varieties.

13306 to 13312. LATHYRUS ODORATUS. **Sweet pea.**

From Algiers, Algeria. Presented by Mr. Arkwright F. Telemly. Received April 7, 1905.

Early-maturing sweet peas, as follows:

13306. Blue and red.

13307. Blue.

13308. Rose and white.

13309. Lilac.

13310. Purple and bronze.

13311. Purple.

13312. Red.

13313 to 13315. CHRYSANTHEMUM LEUCANTHEMUM hyb. **Shasta daisy.**

From Santa Rosa, Cal. Received thru Mr. Luther Burbank, April 7, 1905.

13313. *California.*
13314. *Westralia.*
13315. *Alaska.*

13316 to 13318.

From Lawrence, Kans. Received thru F. Barteldes & Co., April 7, 1905.

13316. ANDROPOGON SORGHUM. **Sorghum.**

Amber.

13317. ANDROPOGON SORGHUM. **Kafir corn.**

White.

13318. ANDROPOGON SORGHUM. **Kafir corn.**

Red.

13319. ASPARAGUS DUCHESNII.

From Brussels, Belgium. Received thru Mr. H. Schuster, 66 Rue du Luxembourg, April 8, 1905.

13320 to 13337. ROSA sp. **Rose.**

From Newtownards, County Down, Ireland. Received thru Alex. Dickson & Sons (Limited), Royal Irish Nurseries, April 8, 1905.

13320. *Dean Hole.*
13321. *Dr. J. Campbell.*
13322. *Hugh Watson.*
13323. *Lady Ashtown.*
13324. *Mrs. Conway Jones.*
13325. *Rev. David Williamson.*
13326. *Irish Engineer.*
13327. *Irish Harmony.*
13328. *Perle des Jannes.*
13329. *Baron Lade.*
13330. *Annie Marie Soupert.*
13331. *George Laine Paul.*
13332. *Le Progrès.*
13333. *Rugosa Delicata.*
13334. *Souv. de Pierre Leperdrieux.*
13335. *Schneehlecht.*
13336. *Andenkah Job Diering.*
13337. *Mme. Jean Dupuy.*

13338. MANGIFERA INDICA. **Mango.**

From Lucknow, India. Received from the Royal Botanical Gardens, thru Mr. Robert Anderson, Lansdowne, Pa., April 11, 1905.

Bombay.

13339. LOLIUM ITALICUM. **Italian rye-grass.**

From New York, N. Y. Received thru J. M. Thorburn & Co., April 8, 1905.

13340. MECONOPSIS INTEGRIFOLIA. **Tibetan poppy.**

From Chelsea, England. Received thru James Veitch & Sons (Limited), August 14, 1905.

"English saved seed. A hardy yellow-flowered poppy from Tibet; hardy, biennial. The plant thrives on the north side of a hedge or wall and grows and flowers freely in open borders. The soil should be open and friable, with a large proportion of peat and sand. Good drainage and ample moisture are required. The seed germinates freely either in a cold frame or out of doors in a few weeks from the time of sowing. Any attempt at any time to protect the plants is quite fatal." (*Veitch & Sons.*)

13341 to 13345. CUCUMIS MELO. **Muskmelon.**

From Detroit, Mich. Received thru D. M. Ferry & Co., April 8, 1905.

13341.	*Osage.*	**13344.**	*Baltimore.*
13342.	*Defender.*	**13345.**	*Emerald Gem.*
13343.	*Bay View.*		

13346. HORDEUM DISTICHUM NUTANS. **Two-row barley.**

From Jena, Germany. Received from Doctor Broili, thru the Wahl-Henius Institute of Fermentology, Chicago, Ill., April 10, 1905.

Frankish Brewing. Presumably a high-grade pedigreed sort.

13347. BERBERIS sp. **Barberry.**

From Gloucester, Mass. Received thru Mr. R. P. Ireland, April 13, 1905.

13348. MANGIFERA INDICA. **Mango.**

From Seharunpur, India. Received thru Mr. W. Gollan, superintendent of the Government Botanical Gardens, April 13, 1905.

Bombay Yellow. Plants.

13349. GARCINIA XANTHOCHYMUS.

From Honolulu, Hawaii. Presented by Mr. Gerrit P. Wilder, April 13, 1905.

13350. OPUNTIA FICUS-INDICA (?). **Prickly pear.**

From Nice, France. Presented by Dr. A. Robertson-Proschowsky. Received April 10, 1905.

"Cuttings of a seedling cactus grown by Doctor Proschowsky from seeds received probably from Mexico. This variety has never been fruited, but is so nearly spineless that it may be of interest as a forage plant." (*Fairchild.*)

13351 to 13353. **Barberry.**

From Ottawa, Canada. Presented by Prof. William Saunders, director of the Central Experimental Farm. Received April 10, 1905.

13351.	BERBERIS AMURENSIS.	**13353.**	BERBERIS SIEBOLDI.
13352.	BERBERIS SINENSIS.		

13354. ZEA MAYS. **Popcorn.**

From Karachi, India. Presented by Mr. I. L. F. Beaumont, of the Municipal Gardens and Farm Committee. Received April 10, 1905.

13355. CUCUMIS MELO. **Muskmelon.**

From Lakin, Kans. Received thru Mr. William Logan, January 26, 1905.

Rocky Ford.

13356. VICIA SATIVA. **Common vetch.**

From New Era, Oreg. Received thru Mr. Henry Gilbrich, April, 1905.

White. Said to have been bred by selection from the common type.

13357. ZEA MAYS. **Sweet corn.**

From Winooski, Vt. Received thru Mr. M. E. Douglass, March 3, 1905.

Malakof. Grown from S. P. I. No. 9449. Second generation. "No other early corn nearer than 1 mile either in 1903 or 1904." (*D. S. Bliss.*)

13358. MEDICAGO SATIVA. **Alfalfa.**

From Agricultural College, N. Dak. Received from the North Dakota Agricultural Experiment Station, thru Mr. C. J. Brand, October 28, 1904.

Grimm.

13359 to 13566.

Seeds transferred April 15, 1905, from the Office of Grass and Forage Plant Investigations to the Office of Seed and Plant Introduction and Distribution.

13359. ANTHOXANTHUM ODORATUM. **Sweet vernal grass.**

From Germany, 1904. (Agrost. 2384). From the Louisiana Purchase Exposition, 1904.

13360. CEPHALARIA TATARICA.

Grown in U. S. D. A. grass garden, 1902. (Agrost. 307.)

13361. CEPHALARIA TATARICA.

Grown in U. S. D. A. grass garden, July, 1904. (Agrost. 307.)

13362 to 13369. CICER ARIETINUM. **Chick-pea.**

13362. Grown at Arlington Farm, 1902. (Agrost. 970–1.)

13363. From Parma, Italy. (Agrost. 2456.)

13364. From Voghera, Italy. (Agrost. 2457.)

13365. From Voghera, Italy. (Agrost. 2458.)

13366. From Avellino, Italy. (Agrost. 2459.)

13367. From Italy. (Agrost. 2460.)

13368. From Italy. (Agrost. 2461.)

13369. From Italy. (Agrost. 2462.)

13370. BROMUS MARGINATUS.

From Seattle, Wash. Received thru Mr. Henry N. Leckenby. (Agrost. 1886.)

13371 to 13376.

Received from Mr. S. W. Mollison, Inspector-General of Agriculture for India.

13371. DOLICHOS BIFLORUS.

Kulthi. From United Provinces of Agra and Oudh, India. (Agrost. 1646.)

13372. DOLICHOS BIFLORUS.

Kulthi. From Bombay Presidency, India. (Agrost. 1647.)

13373. DOLICHOS LABLAB. **Hyacinth bean.**

Popat. From Nagpur, Central Provinces, India, 1903. (Agrost. 1648.)

13374. DOLICHOS LABLAB. **Hyacinth bean.**

Sem. From United Provinces of Agra and Oudh, India, 1903. (Agrost. 1649.)

13375. DOLICHOS LABLAB. **Hyacinth bean.**

Val. From Bombay, India, 1903. (Agrost. 1650.)

13376. DOLICHOS LABLAB. **Hyacinth bean.**

Val. From Bombay, India, 1903. (Agrost. 1651.)

13377. HOLCUS LANATUS. **Velvet grass.**

Received thru the C. H. Lilly Company, Seattle, Wash., 1904. (Agrost. 2094.)

13359 to 13556—Continued.

13378. Lathyrus sativus. **Bitter vetch.**

From Catania, Italy, 1904. From Italian exhibit, Louisiana Purchase Exposition. (Agrost. 2389.)

13379. Lathyrus cicer. **Winter flat pea.**

From Catania, Italy, 1904. From Italian exhibit, Louisiana Purchase Exposition. (Agrost. 2406.)

13380. Phaseolus calcaratus. **Bean.**

From the Alabama Agricultural Experiment Station. (Agrost. 2126.)

13381. Phaseolus calcaratus. **Bean.**

Grown at Arlington Farm, 1903, from S. P. I. No. 6564. (Agrost. 941-1 a 1.)

13382. Phaseolus calcaratus. **Bean.**

A selection grown at Arlington Farm, 1903, from S. P. I. No. 6564. (Agrost. 941-1 c 1.)

13383. Phaseolus calcaratus. **Bean.**

A selection grown at Arlington Farm, 1903, from S. P. I. No. 6564. (Agrost. 941-1 d 1.)

13384. Phaseolus angularis. **Bean.**

Grown at Arlington Farm, 1903. (Agrost. 969½-1 a 1.) Seeds yellow to light orange.

13385. Phaseolus angularis. **Bean.**

Grown at Arlington Farm, 1903. (Agrost. 969½-1 b 1.)

13386. Phaseolus angularis. **Bean.**

Grown at Arlington Farm, 1903. (Agrost. 969½-1 c 1.)

13387. Phaseolus angularis. **Bean.**

Grown at Arlington Farm, 1903. (Agrost. 969½-1 e 1.)

13388. Phaseolus angularis. **Bean.**

Grown at Arlington Farm, 1903. (Agrost. 969½-1 f 1.)

13389. Phaseolus angularis. **Bean.**

Grown at Arlington Farm, 1903. (Agrost. 969½-1 g 1.)

13390. Phaseolus angularis. **Bean.**

Grown at Arlington Farm, 1903. (Agrost. 969½-1 h 1.)

13391. Phaseolus angularis. **Bean.**

Grown at Arlington Farm, 1903. (Agrost. 1190-1.)

13392. Phaseolus sp. **Bean.**

Grown at Arlington Farm, 1903. (Agrost. 1191.)

13393. Phaseolus sp. **Bean.**

Special selection with large seeds grown at Arlington Farm, 1903. (Agrost. 1191-1.)

13394. Phaseolus radiatus. **Mung bean.**

Grown at Arlington Farm, 1903. (Agrost. 968.)

13395. Phaseolus radiatus. **Mung bean.**

From Clemson College, S. C., 1903. (Agrost. 1112.)

Newman.

13359 to 13556—Continued.

13396 and 13397.

Received from Mr. S. W. Mollison, Inspector-General of Agriculture in India.

13396. PHASEOLUS RADIATUS. **Mung bean.**

From United Provinces of Agra and Oudh, India, July 8, 1903. (Agrost. 1639.)

13397. PHASEOLUS RADIATUS. **Mung bean.**

From Nagpur, Central Provinces, India, 1903. (Agrost. 1640.)

13398. PHASEOLUS RADIATUS. **Mung bean.**

From Cedartown, Ga., November, 1904. (Agrost. 2130.)

13399 to 13403.

Received from Mr. S. W. Mollison, Inspector-General of Agriculture in India.

13399. PHASEOLUS RADIATUS. **Mung bean.**

Katikha. From United Provinces of Agra and Oudh, India, 1903. (Agrost. 1641.)

13400. PHASEOLUS MAX. **Mung bean.**

Bhadela. From United Provinces of Agra and Oudh, India, 1903. (Agrost. 1642.)

13401. PHASEOLUS MAX. **Mung bean.**

Jathia (?), or *Jettira.* From United Provinces of Agra and Oudh, India, 1903. (Agrost. 1643.)

13402. PHASEOLUS MAX. **Mung bean.**

Udid. From Bombay Presidency, India, 1903. (Agrost. 1644.)

13403. PHASEOLUS MAX. **Mung bean.**

Udid. From Nagpur, Central Provinces, India, July 8, 1903. (Agrost. 1645.)

13404. PHASEOLUS RETUSUS. **Metcalf bean.**

From Silver City, N. Mex., April 28, 1903. (Agrost. 1176.)

13405. PHASEOLUS ANGULARIS. **Bean.**

Grown at Arlington Farm, 1903. (Agrost. 941½.)

13406. VICIA sp. **Vetch.**

From Argentine exhibit, Louisiana Purchase Exposition. (Agrost. 2327.)

13407. VICIA sp. **Vetch.**

From German exhibit, Louisiana Purchase Exposition. (Agrost. 2455.)

13408. VICIA sp. **Vetch.**

Grown at Arlington Farm, 1902. (Agrost. 965; S. P. I. 6553.)

13409. VICIA sp. **Vetch.**

Grown at Arlington Farm, 1902. (Agrost. 942-1.)

13410. VICIA ERVILIA. **Black bitter vetch.**

From Italian exhibit, Louisiana Purchase Exposition, 1904. (Agrost. 2403.)

13411. VICIA FABA. **Horse bean.**

From Naples, Italy, 1904. From Italian exhibit, Louisiana Purchase Exposition. (Agrost. 2415.)

13412. VICIA SATIVA. **Common vetch.**

From Argentine exhibit, Louisiana Purchase Exposition. (Agrost. 2314.)

13413 to 13431. VICIA SATIVA. **Common vetch.**

From Italian exhibit, Louisiana Purchase Exposition.

13413. From Italy. (Agrost. 2388.)

13359 to 13556—Continued.

13413 to 13431—Continued.

13414. From Reggio nell' Emilia, Italy. (Agrost. 2390.)

13415. From Rome, Italy, 1904. (Agrost. 2391.)

13416. From Fabriano, Italy, 1904. (Agrost. 2392.)

13417. From Italy, 1904. (Agrost. 2394.)

13418. From Pistoja, Italy, 1904. (Agrost. 2395.)

13419. From Milan, Italy, 1904. (Agrost. 2398.)

13420. From Italy, 1904. (Agrost. 2399.)

13421. From Fabriano, Italy, 1904. (Agrost. 2400.)

13422. From Fabriano, Italy, 1904. (Agrost. 2402.)

13423. From Potenza, Italy, 1904. (Agrost. 2404.)

13424. From Macerata, Italy, 1904. (Agrost. 2405.)

13425. From Ancona, Italy, 1904. (Agrost. 2408.)

13426. From Ancona, Italy, 1904. (Agrost. 2409.)

13427. From Tursla, Italy, 1904. (Agrost. 2410.)

13428. From Parma, Italy, 1904. (Agrost. 2411.)

13429. From Perugia, Italy, 1904. (Agrost. 2413.)

13430. From Foggia, Italy, 1904. (Agrost. 2414.)

13431. From Italy, 1904. (Agrost. 2432.)

13432. VICIA UNIJUGA (?). **Vetch.**

From Japan, March 18, 1903. (Agrost. 1140.)

13433. VICIA VILLOSA. **Hairy vetch.**

From Argentine exhibit, Louisiana Purchase Exposition. (Agrost. 2317.)

13434. THEMEDA CILIATA.

From Palghar, Thana, India. Received thru Latham & Co., Bombay, India, January 20, 1904.

Bondani, a small kind of "Ful" grass. "One of the best sorts of grasses for grazing." (Agrost. 1787.)

13435. MEDICAGO SATIVA. **Alfalfa.**

Received from Henry Nungesser & Co., New York, N. Y., April 20, 1904.

Turkestan. (Agrost. 1957.)

13436. MEDICAGO SATIVA. **Alfalfa.**

Received from Steele, Briggs Seed Co., Toronto, Canada, December 8, 1904. (Agrost. 2131.)

13437. MEDICAGO SATIVA. **Alfalfa.**

Received from F. Barteldes & Co., Lawrence, Kans., 1904.

Arizona grown. (Agrost. 2518.)

13438. MEDICAGO SATIVA. **Alfalfa.**

Received from F. Barteldes & Co., Lawrence, Kans., 1904.

Minnesota grown. (Agrost. 2531.)

13439. MEDICAGO SATIVA. **Alfalfa.**

Kansas grown. (Agrost. 2530.)

13440. MEDICAGO SATIVA. **Alfalfa.**

Kansas grown. (Agrost. 2531).

13359 to 13556—Continued.

13441. Agropyron occidentale.

From Hays, Kans. (Agrost. 1942.)

13442. Agropyron occidentale.

From Harlem, Mont. (Agrost. 1982.)

13443. Agropyron occidentale.

(Agrost. 1001.)

13444. Bromus carinatus hookerianus.

From Seattle, Wash. (Agrost. 1887.)

13445. Bromus carinatus hookerianus.

From Union, Oreg. (Agrost. 2097.)

13446. Bromus inermis. **Smooth brome-grass.**

From Brandon, Mass. Received thru Brandon Seed House. (Agrost. 1996.)

13447. Bromus marginatus.

From Union, Oreg. (Agrost. 2091.)

13448. Bromus polyanthus paniculatus. (Agrost. 1177.)

13449. Calamagrostis hyperborea. (Agrost. 841.)

13450. Elymus condensatus. **Giant rye-grass.**

From Union, Oreg. (Agrost. 2092.)

13451. Elymus triticoides. (Agrost. 2096.) **Wild wheat.**

13452. Elymus virginicus submuticus.

From Union, Oreg. (Agrost. 1800.)

13453. Festuca pratensis. **Meadow fescue.**

From Union, Oreg. (Agrost. 1799.)

13454 to 13477. Vigna sinensis. **Cowpea.**

13454.

Early Black. Grown on Arlington Farm, 1904. Third generation from Agrost. 1233. From McCullough, March, 1902. (Agrost. 1233-3.)

13455.

Large Blackeye. Grown on Arlington Farm, 1904. Third generation from Agrost. 1224. From Alabama Experiment Station, March, 1902. (Agrost. 1224-3.)

13456.

Extra Early Blackeye. Grown on Arlington Farm, 1904. Third generation from Agrost. 1232. From Arkansas Station, March, 1902. Grown there for five years. (Agrost. 1232-3.)

13457.

California Blackeye. Grown on Arlington Farm, 1904. Third generation from Agrost. 1231. From Arkansas Station, March, 1904. (Agrost. 1231-3.)

13458.

Clay. Grown on Arlington Farm, 1904. Third generation from Agrost. 1255. From South Carolina Station, March, 1902. (Agrost. 1255-3.)

13459.

Clay. From T. W. Wood & Sons, April 2, 1904. (Agrost. 1937.)

13460.

Iron. Grown on Arlington Farm, 1904. Third generation from Agrost. 1247. From Mr. W. A. Orton, March, 1902. (Agrost. 1247-3.)

13359 to 13556--Continued.

13454 to 13477--Continued.

13461.

Iron. Grown by Mr. J. P. Dunlap, Dwight, Nebr., from seed of Congressional distribution, presumably from Monetta, S. C. Received from Mr. Dunlap, October, 1904. (Agrost. 2109.)

13462.

Iron. Received from Mr. S. M. Byrd, Cedartown, Ga., January 11, 1905. Grown in 1904 from seed of Congressional distribution, presumably from Monetta, S. C. (Agrost. 2136.)

13463.

Iron. Received from Mr. W. J. Edwards, Willshire, Ohio, March 6, 1905, and from Mr. J. A. Ritchie, Wapakoneta, Ohio, March 20, 1905. Grown from seed of Congressional distribution, presumably from Monetta, S. C. (Agrost. 2217.)

13464.

Iron. Received from four men in central Kentucky and southern Illinois, who grew it in 1904 from seed of Congressional distribution, presumably from Monetta, S. C. (Agrost. 2260.)

13465.

Iron. Received in March, 1905, from Mr. Han Abild, Wakonda, Clay County, S. Dak., who grew it in 1904 from seed of Congressional distribution, presumably from Monetta, S. C. (Agrost. 2310.)

13466.

Iron. Received from Mr. Charles G. Diament, Bridgeton, N. J., March 8, 1905. Grown from seed of Congressional distribution, presumably from Monetta, S. C. (Agrost. 2386.)

13467.

Iron. Received from G. C. Dulebohn, Kearney, Kans., March, 1905. Grown from seed of Congressional distribution, presumably from Monetta, S. C. (Agrost. 2387.)

13468.

Wonderful. Grown on Arlington Farm, 1904. From Texas Seed and Floral Company, Dallas, Tex., March, 1902. (Agrost. 1251-3.)

13469.

Wonderful. From T. W. Wood & Sons, Richmond, Va., April 2, 1904. (Agrost. 1938.)

13470.

Warren's Extra Early. Grown on Arlington Farm, 1904. Obtained in March, 1902, from Arkansas station, where it was grown for four years, and changed materially in size, color, and shape from the original seed procured from Maule, of Philadelphia. (Agrost. 1218-3.)

13471.

Warren's New Hybrid. Grown on Arlington Farm, 1904. From Louisiana station, March, 1902. (Agrost. 1288-3.)

13472.

Michigan Favorite. From Mr. E. E. Evans, Westbranch, Mich., May 13, 1904. (Agrost. 1991.)

13473.

Michigan Favorite. Grown on Arlington Farm, 1904. From Mr. E. E. Evans, Westbranch, Mich., May 13, 1904. (Agrost. 1991-1.)

13474.

Michigan Favorite. Received in March, 1905, from Mr. Han Abild, Wakonda, Clay County, S. Dak. Grown from seed of Congressional distribution, presumably from Monetta, S. C. (Agrost. 2309.)

13359 to 13556—Continued.

13454 to 13477—Continued.

13475.

Whippoorwill. Grown on Arlington Farm, 1904. From T. W. Wood & Sons, Richmond, Va., March, 1902. (Agrost. 1269-2.)

13476.

Taylor. Grown on Arlington Farm, 1904. From Alabama Station, March, 1902. (Agrost. 1248-3.)

13477.

New Era. Grown on Arlington Farm, 1904. From T. W. Wood & Sons, Richmond, Va., April 2, 1904. (Agrost. 1936-1.)

13478 to 13487. Medicago sativa. **Alfalfa.**

13478.

Received from F. Barteldes & Co., Lawrence, Kans., April 22, 1904. (Agrost. 1968.)

13479.

Grown in Arizona. Received from Henry Nungesser & Co., New York, N. Y., April 20, 1904. (Agrost. 1958.)

13480.

Grown in Meade County, Kans. Received from F. Barteldes & Co., Lawrence, Kans., April 22, 1904. (Agrost. 1970.)

13481.

Grown in Italy. Received from Henry Nungesser & Co., New York, N. Y., April 20, 1906. (Agrost. 1956.)

13482.

Grown in France. Received from Henry Nungesser & Co., New York, N. Y., April 20, 1904. (Agrost. 1955.)

13483.

Grown in Utah. Received from C. A. Smurthwaite Produce Company, Ogden, Utah, April 25, 1904. (Agrost. 1983.)

13484.

Grown in Colorado. Received from F. Barteldes & Co., Lawrence, Kans., April 20, 1904. (Agrost. 1967.)

13485.

Grown in Kansas. Received from F. Barteldes & Co., Lawrence, Kans., April 20, 1904. (Agrost. 1969.)

13486.

Grown in Utah. (Agrost. 2532.)

13487.

Grown in Texas. (Agrost. 2533.)

13488. Medicago media. **Sand lucern.**

Grown in Wisconsin. (Agrost. 2534.)

13489. Medicago sativa. **Alfalfa.**

Grown in Wyoming. Received from the A. Dickinson Company, Chicago, Ill., 1903. (Agrost. 1885.)

13490. Trifolium pratense. **Red clover.**

Received from T. W. Wood & Sons, Richmond, Va., April 18, 1904. (Agrost. 1952.)

13359 to 13556—Continued.

13491. TRIFOLIUM INCARNATUM. **Crimson clover.**

White Blooming. Received from T. W. Wood & Son, Richmond, Va., April 18, 1904. (Agrost. 1953.)

13492. TRIFOLIUM INCARNATUM. **Crimson clover.**

Grown in Moravia. Received from Henry Nungesser & Co., New York, N. Y., April 20, 1904. (Agrost. 1964.)

13493. TRIFOLIUM INCARNATUM. **Crimson clover.**

Grown in France. Received from Henry Nungesser & Co., New York, N. Y., April 20, 1904. (Agrost. 1961.)

13494. TRIFOLIUM INCARNATUM. **Crimson clover.**

Grown in Italy. Received from Henry Nungesser & Co., New York, N. Y., April 20, 1904. (Agrost. 1962.)

13495. TRIFOLIUM PRATENSE. **Red clover.**

Received from F. Barteldes & Co., Lawrence, Kans., April 22, 1904. (Agrost. 1955.)

13496. TRIFOLIUM PRATENSE. **Red clover.**

Grown in Barry County, Mo. Received from F. Barteldes & Co., Lawrence, Kans., April 22, 1904. (Agrost. 1966.)

13497. TRIFOLIUM INCARNATUM. **Crimson clover.**

Grown in England. Received from Henry Nungesser & Co., New York, N. Y., April 20, 1903. (Agrost. 1963.)

13498. TRIFOLIUM PRATENSE. **Red clover.**

Grown in Russia. Received from Henry Nungesser & Co., New York, N. Y., April 20, 1903. (Agrost. 1960.)

13499. TRIFOLIUM PRATENSE. **Red clover.**

Received from T. W. Wood & Sons, Richmond, Va., February 19, 1903. (Agrost. 1113.)

13500. TRIFOLIUM ALEXANDRINUM. **Berseem.**

Grown in Egypt. Received from Henry Nungesser & Co , New York, N. Y., April 20, 1904. (Agrost. 1959.)

13501. TRIFOLIUM HYBRIDUM. **Alsike.**

(Agrost. 891.)

13502. GLYCINE HISPIDA. **Soy bean.**

Ogema. Received from Mr. Edward E. Evans, West Branch, Mich., May, 1904. (Agrost. 1992.)

13503. GLYCINE HISPIDA. **Soy bean.**

Grown at Arlington Farm, 1904. (Agrost. 912–3.)

13504. AGROPYRON OCCIDENTALE.

Received from Thomas Everett, Harlem, Mont., April, 1905.

13505. BROMUS MARGINATUS.

Collected by Mr. J. S. Cotton, in the Wenache Mountains, Washington, in 1904. (Agrost. 2098.)

13506. TRIFOLIUM PRATENSE. **Red clover.**

Grown at Gap, French Alps, France. (Agrost. 2218.)

13507. TRIFOLIUM PRATENSE. **Red clover.**

Grown at Mysoke, Myto, Bohemia. (Agrost. 2219.)

13508. TRIFOLIUM PRATENSE. **Red clover.**

Grown at Neu Bydzow, Bohemia. (Agrost. 2220.)

13359 to 13556—Continued.

13509. Trifolium pratense. **Red clover.**

Zelenac. Grown at Neu Bydzow, Bohemia. (Agrost. 2221.)

13510. Trifolium hybridum. **Alsike.**

Grown at Neu Bydzow, Bohemia. (Agrost. 2222.)

13511. Trifolium repens. **White clover**

Grown at Alt Bydzow, Bohemia. (Agrost. 2223.)

13512. Trifolium repens. **White clover.**

Grown at Podolia, Russia. (Agrost. 2224.)

13513. Trifolium pratense. **Red clover.**

Grown at Goteborg, Sweden. (Agrost. 2225.)

13514. Trifolium hybridum. **Alsike.**

Grown at Goteborg, Sweden. (Agrost. 2226.)

13515. Trifolium pratense. **Red clover.**

Grown in Chile. (Agrost. 2227.)

13516. Trifolium pratense. **Red clover.**

Grown at Gelderland, Holland. (Agrost. 2228.)

13517. Trifolium pratense. **Red clover.**

Grown at Brabant, Holland. (Agrost. 2229.)

13518. Trifolium repens. **White clover.**

Grown near Arnheim, Holland. (Agrost. 2230.)

13519. Medicago sativa. **Alfalfa.**

Grown at Saragossa, Spain. (Agrost. 2231.)

13520. Medicago sativa. **Alfalfa.**

Grown at Pfalz, Palatinate, Germany. (Agrost. 2232.)

13521. Medicago sativa. **Alfalfa.**

Grown in Oran Province, Algeria. (Agrost. 2233.)

13522. Trifolium pratense. **Red clover.**

Grown at Toulouse, Garonne, France. (Agrost. 2234.)

13523. Trifolium pratense. **Red clover.**

Grown at Charente-Inferieure, Poitou, France. (Agrost. 2235.)

13524. Trifolium pratense. **Red clover.**

Grown at Nantes, Anjou, France. (Agrost. 2236.)

13525. Trifolium pratense. **Red clover.**

Grown at Troyes, Champagne, France. (Agrost. 2237.)

13526. Trifolium pratense. **Red clover.**

Grown at St. Malo, Bretagne, France. (Agrost. 2238.)

13527. Trifolium pratense. **Red clover.**

Grown at Albeville, Picardy, France. (Agrost. 2239.)

13528. Trifolium alexandrinum. **Berseem.**

Grown at Alexandria, Egypt. (Agrost. 2240.)

13529. Trifolium repens. **White clover.**

Grown at Milan, Lodi, Italy. (Agrost. 2241.)

13530. Trifolium repens. **White clover.**

Grown at Lorraine, France. (Agrost. 2242.)

13359 to 13556—Continued.

13531. Trifolium repens. **White clover.**

Grown at Lorraine, France. (Agrost. 2243.)

13532. Trifolium filiforme.

Grown at Poitiers, France. (Agrost. 2244.)

13533. Trifolium fragiferum.

Grown at Paris, France. (Agrost. 2245.)

13534. Trifolium hybridum. **Alsike.**

Grown at Beauce, France. (Agrost. 2246.)

13535. Trifolium hybridum. **Alsike.**

Grown at Champagne, France. (Agrost. 2247.)

13536. Trifolium pannonicum. **Hungarian clover.**

Grown at Paris, France. (Agrost. 2248.)

13537. Trifolium incarnatum. **Crimson clover.**

Grown at Poitou, France. (Agrost. 2249.)

13538. Trifolium incarnatum. **Crimson clover.**

Grown at Beauce, France. (Agrost. 2250.)

13539. Trifolium incarnatum. **Crimson clover.**

Grown at Beauce, France. (Agrost. 2251.)

13540. Trifolium incarnatum. **Crimson clover.**

Grown at Beauce, France. (Agrost. 2252.)

13541. Medicago sativa. **Alfalfa.**

Grown at Gard, France. (Agrost. 2253.)

13542. Medicago sativa. **Alfalfa.**

Grown at Orange, Provence, France. (Agrost. 2254.)

13543. Medicago sativa. **Alfalfa.**

Grown at Charente, Poitou, France. (Agrost. 2255.)

13544. Medicago sativa. **Alfalfa.**

Grown at Anjou, Pays, France. (Agrost. 2256.)

13545. Medicago sativa. **Alfalfa.**

Grown at Nord, France. (Agrost. 2257.)

13546. Medicago sativa. **Alfalfa.**

From Turkestan, Asia. (Agrost. 2258.)

13547. Medicago sativa. **Alfalfa.**

Grown at Bologna, Italy. (Agrost. 2525.)

13548. Trifolium pratense. **Red clover.**

Grown at Warwickshire, England. (Agrost. 2526.)

13549. Trifolium pratense. **Red clover.**

Grown at Hampshire, England. (Agrost. 2527.)

13550. Trifolium repens. **White clover.**

Grown at Norfolkshire, England. (Agrost. 2528.)

13551. Trifolium hybridum. **Alsike.**

Grown at Cambridge, England. (Agrost. 2529.)

13552. Medicago denticulata. **Bur clover.**

From T. W. Wood & Sons, Richmond, Va., March 16, 1903. (Agrost. 1129.)

13359 to 13556—Continued.

13553. ATRIPLEX BRACTEOSA.

From Phoenix, Ariz. Collected by Dr. D. Griffiths, October 16, 1903. (Agrost. 1824.)

13554. ATRIPLEX BRACTEOSA.

From Tucson, Ariz. Collected by Dr. D. Griffiths, October 11, 1903. (Agrost. 1825.)

13555. ATRIPLEX BRACTEOSA.

From San Rita Mountains, Arizona. Collected by Dr. D. Griffiths, October 10, 1903. (Agrost. 1826.)

13556. ATRIPLEX CONFERTIFOLIA.

Collected by Dr. D. Griffiths, 1903. From valley of the Little Colorado, Arizona. (Agrost. 1828.)

13557. ATRIPLEX BRACTEOSA.

From Santa Rita Mountains, Arizona. Collected by Dr. D. Griffiths, May 23, 1903. (Agrost. 1827.)

13558. MELILOTUS SULCATA.

From Algeria, October, 1903. (Agrost. 1161.)

13559. MELILOTUS SPECIOSA.

From Shao-king, Chehkiang Province, China. Received February 12, 1904. Presented by Mr. Cyril E. Bomfield.

"The Chinese mainly use its heavy, rank growth for fertilizing the soil previous to sowing rice." (Agrost. 1866.)

13560. TRIFOLIUM LONGIPES. **Mountain clover.**

From Wenache Mountains, Washington, at altitude of 5,000 feet. Collected by Mr. J. S. Cotton, October, 1904. (Agrost. 2108.)

13561. MEDICAGO SATIVA. **Alfalfa.**

From A. LeCoq & Co., Darmstadt, Germany, March 28, 1903.

Turkestan. (Agrost. 2208.)

13562. HORDEUM BULBOSUM.

Received June 28, 1904. (Agrost. 263.)

13563. PANICUM MAXIMUM. **Guinea grass.**

From Barbados, West Indies.

13564. MEDICAGO SATIVA. **Alfalfa.**

From Mollendo, Peru. Collected by Mr. Enrique Meier in 1903. (Agrost. 2168.)

13565. ANDROPOGON SORGHUM. **Milo maize.**

Purchased from Mr. W. W. Hutchens, Chillicothe, Tex., in the autumn of 1904. (Agrost. 2090.)

13566. BOUTELOUA CURTIPENDULA. **Side oats.**

Received from Mr. James K. Metcalfe, Silver City, N. Mex., February 26, 1904. (Agrost. 1889.)

13567. OLEA EUROPAEA. **Olive.**

From Tunis, North Africa. Received from Mr. Louis Fidelle, thru Mr. T. H. Kearney, April 20, 1905.

Chemlali. "This is an olive with very small fruit, very rich in oil, and a heavy yielder, adapted to the driest, hottest region known in which olive culture flourishes, the rainfall at Sfax, in southern Tunis, where it is the only variety grown extensively, averaging about 10 inches yearly, and sometimes falling to 5 or 6 inches as the average for several successive years. Notwithstanding this small rainfall, the orchards are never irrigated at Sfax except during the first two or three summers after planting. In some orchards the cuttings are irrigated only a single time, receiving about 6 gallons each. Extraordinary precautions are taken to preserve the soil moisture near the surface, the olive being a shallow-rooting tree. The trees are planted from 65 to 80 feet apart each way, the wider planting giving seven trees per acre. The ground between is kept entirely clean, not even grain crops being grown after the tree begins to bear. The surface of the soil is always kept in a well-pulverized condition to reduce evaporation. Three or four plowings a year are given, and as many cultivations as are necessary to keep out weeds. Manuring is practised only to a very limited extent. The orchards at Sfax are always created with pieces of wood from the base of very old trees, such as those sent you. The cuttings are generally set out in the fall (but sometimes in the spring) in the bottom of holes that are 2 feet deep and 2 feet square. These are filled up as the tree grows, until in about two years they are entirely filled. It is often the practise to keep a shallow basin, 6 inches or so deep, around the base of the tree during the rainy season (winter), the diameter of the basin being about equal to that of the spread of the foliage. In summer the ground is plowed up to the bases of the trees. The soil around Sfax is a reddish sandy loam to a depth of 2 or 3 feet or more, below which hardpan is often encountered.

"The trees are pruned during the harvest every other year, beginning when 3 years old. The average yields obtained at Sfax from trees respectively 10, 15, 20, and 25 years old appear to be about 2, 6, 10, and 12½ quarts of oil per tree. In good years twice as much is obtained. The percentage of oil in the fruit, as well as the quantity of fruit produced, increases rapidly as the tree grows older." (*Kearney.*)

13568. MUSA SAPIENTUM. **Banana.**

From Gabes, Tunis, North Africa. Received thru Mr. T. H. Kearney, April 20, 1905.

13569. PISTACIA VERA. **Pistache.**

From Caltanisetta, Sicily. Received thru Mr. T. H. Kearney, from Signor Deleo, April 20, 1904.

Trabonella.

13570. ZEA MAYS. **Sweet corn.**

From Riverside Farm, Nashua, N. H. Received April 17, 1905.

Crosby. Said to be the result of eighteen years' selection.

13571. NEPHELIUM LAPPACEUM. **Rambutan.**

From Buitenzorg, Java. Received thru Doctor Treub, April 22, 1905.

Native of south India and Malay Islands, and furnishes a fruit similar to the Litchi, namely, the Rambutan or Ramboostan fruit. All species of Nephelium seem to require rather a moist, mild, forest clime than great atmospheric heat.

The fruit is of a bright-red color, about 2 inches long, of an oval form, and slightly flattened, and covered with long, soft, fleshy spines or thick hairs. Like the other Nepheliums it contains a pleasant acidulous pulp very grateful in tropical countries.

13572. GARCINIA MANGOSTANA. **Mangosteen.**

From Buitenzorg, Java. Received thru Doctor Treub, April 17, 1905.

13573. JUGLANS REGIA. **Persian walnut.**

From Kashgar, eastern Turkestan, Asia. Presented by Rev. P. J. P. Hendriks. Received April 11, 1905.

13574. GLYCYRRHIZA GLABRA. **Licorice.**

From London, England. Received thru Messrs. Barr & Sons, April 17, 1905.

13575. ALTHAEA ROSEA. **Hollyhock.**

From New York, N. Y. Received from Henry & Lee, importers, March, 1905.

Japanese.

13576 to 13582.

From Christiania, Norway. Presented by Mr. C. Doxrud, thru Miss Carrie Harrison, of this Department. Received April 13, 1905.

13576. AVENA SATIVA. **Oat.**

White. Cultivated in 1898 under the Arctic Circle.

13577. AVENA SATIVA. **Oat.**

Black. Cultivated at northern latitude of 64°.

13578. HORDEUM VULGARE (?). **Barley.**

Cultivated in 1898 under the Arctic Circle.

13579. PISUM SATIVUM. **Pea.**

Cultivated at northern latitude of 63½°.

13580. PHLEUM PRATENSE. **Timothy.**

Cultivated at northern latitude of 63½°.

13581. TRIFOLIUM PRATENSE. **Red clover.**

Cultivated at northern latitude of 63½°.

13582. VICIA sp. **Vetch.**

Cultivated at northern latitude of 63½°.

"We are informed that these seeds have been collected within the Arctic Circle, and it is probable that they represent very short-seasoned types, which are likely to be of unusual value in northern Alaska and possibly in portions of our Northern States." (*Fairchild.*)

13583 to 13585. GOSSYPIUM sp. Cotton.

From Peru. Received thru W. R. Grace & Co.. New York, N. Y., April 19, 1905.

13583. *Vitarte.*

Smooth cotton seed from Vitarte; represents the seed of cotton grown in the valleys of Peru. This cotton is similar to Egyptian and is known as "*Egypto*" cotton. It is used by the various cotton mills in this country in the manufacture of "domestics." The surplus is shipped to Liverpool, where it finds a market at a price a little over American cotton, say 0.40d. per pound. There is one crop of this cotton every year, the same as with American cotton. The seed is planted in September or October and the cotton is gathered in May or August the following year. The annual crop is about 7,500,000 pounds.

13584. *Palpa.* **13585.** *Nazca.*

Palpa, *Nazca*, and *Ica* (No. 14801) represent seed of Peruvian cotton grown in these different places, which are in the southern part of Peru. Here the crop is twice a year, same seasons as the "Full rough." Crop varies from 6,000 bales (of 100 pounds) in a dry year to 15,000 bales in a good year. The cotton seed of the "Full rough" (No. 12938) and "Moderate rough" (*Palpa*, *Nazca*, and *Ica*) is exported to England, while the seed of the "*Egypto*" is prest here and the cotton-seed cake, known as "Pasta," is shipped to Liverpool. The oil is sold here chiefly for use in mines, and portions of it as Italian salad oil.

13586. PHALARIS CANARIENSIS. Canary grass.

From Patras, Greece. Presented by Mr. S. Xanthopoulo, of the Station Agricole. Received April 19, 1905.

In his letter of April 1, Mr. Xanthopoulo stated that this seed was procured by him from Turkey.

13587 to 13599.

From Chelsea, England. Received thru James Veitch & Sons, March 28, 1905.

Flower seeds.

13600 to 13620.

From Reading, England. Received thru Sutton & Sons, about March 3, 1905.

Flower seeds.

13621 and 13622. **Matting rush.**

From Tokyo, Japan. Presented by Prof. J. Matsumura, Imperial University. Received April 24, 1905.

13621. JUNCUS EFFUSUS DECIPIENS.

13622. JUNCUS SETCHUENSIS EFFUSOIDES.

13623 to 13636.

From London, England. Received thru Barr & Sons, Covent Garden, March 8, 1905.

Flower seeds.

13637 to 13647.

From New York, N. Y. Received thru J. M. Thorburn & Co., about February 17, 1905.

Flowering perennials.

13648. MEDICAGO CANCELLATA.

From Rostoff on Don, Russia. Received from Mr. George R. Martin, thru the American consular agency, September 21, 1905.

13649 to 13663.

From Erfurt, Germany. Received thru Mr. Ernst Benary, March 16, 1905.

Flower seeds.

13664 to 13693.

From Paris, France. Received thru Vilmorin-Andrieux & Co., March 3, 1905.

Flower seeds.

13694 and 13695.

From Marblehead, Mass. Received thru James J. H. Gregory & Son, February 27, 1905.

Flower seeds.

13696 to 13698.

From Philadelphia, Pa. Received thru Henry A. Dreer, Incorporated, in the spring of 1905.

Flower seeds.

13699 to 13703.

From Naples, Italy. Received thru Mr. Max Herb, in the spring of 1905.

Flower seeds.

13704. RUDBECKIA SPECIOSA BICOLOR.

From Philadelphia, Pa. Received thru W. A. Burpee & Co., February 17, 1905.

13705 to 13707.

From Boston, Mass. Received thru W. W. Rawson & Co., 12 Faneuil Hall Square, about February 15, 1905.

Flower seeds.

13708 to 13711.

From Boston, Mass. Received thru R. & J. Farquhar & Co., in January, 1905.

Flower seeds.

13712 to 13714.

From Ottawa, Ontario, Canada. Presented by Mr. J. B. Lewis, C. E., 126 Sparks street. Received February 21, 1905.

Flower seeds.

13715 to 13718.

From Erfurt, Germany. Received thru Mr. F. C. Heinemann, in the spring of 1905.

Flower seeds.

13719 to 13721.

From Erfurt, Germany. Received thru Haage & Schmidt, in the spring of 1905.

Flower seeds.

13722 and 13723. AQUILEGIA sp. **Columbine.**

From Wordsley, Stourbridge, England. Received thru Webb & Sons, in the spring of 1905.

13724. PAPAVER ORIENTALE hyb. **Poppy.**

From Boston, England. Received thru W. W. Johnson & Co., March 7, 1905.

13725 to 13727.

(Origin and date of receipt uncertain.)

Flower seeds.

13728. LANSIUM DOMESTICUM. **Doekoe.**

From Buitenzorg, Java. Presented by Doctor Treub. Received April 29 and May 4, 1905.

13729 to 13731. PERSEA GRATISSIMA. **Avocado.**

From Miami, Fla. Presented by Mr. George B. Cellon to the Subtropical Laboratory thru Mr. S. B. Bliss. Received April 12, 1905.

13729. *Baldwin.*

13730. *Haden.*

13731. *Rico.*

13732. MORAEA IRIDIOIDES.

From Cape Town, South Africa. Presented by Prof. P. MacOwan, Department of Agriculture. Received April 24, 1905.

A native South African plant, growing 2½ feet high; flowers iris-like.

13733 to 13794.

Seeds transferred from the Office of Grass and Forage Plant Investigations to the Office of Seed and Plant Introduction and Distribution, May 1, 1905.

13733 to 13771.

From the Louisiana Purchase Exposition.

13733. BRASSICA NAPUS. **Rape.**

From Milan, Italy. (Agrost. 2476.)

13733 to 13794—Continued.

13733 to 13771—Continued.

13734. Trifolium pratense. **Red clover.**
From Voghera, Italy. (Agrost. 2477.)

13735. Trifolium pratense. **Red clover.**
From Padova, Italy. (Agrost. 2478.)

13736. Trifolium pratense. **Red clover.**
From Asti, Italy. (Agrost. 2479.)

13737. Trifolium pratense. **Red clover.**
From Lodi, Italy. (Agrost. 2480.)

13738. Medicago sativa. **Alfalfa.**
From Milan, Italy. (Agrost. 2481.)

13739. Medicago sativa. **Alfalfa.**
From Padova, Italy. (Agrost. 2482.)

13740. Trifolium pratense. **Red clover.**
From Lorino, Italy. (Agrost. 2483.)

13741. Trifolium pratense. **Red clover.**
From Aguila, Italy. (Agrost. 2484.)

13742. Medicago lupulina. **Yellow trefoil.**
From Como, Italy. (Agrost. 2485.)

13743. Medicago sativa. **Alfalfa.**
From Treviso, Italy. (Agrost. 2486.)

13744. Medicago sativa. **Alfalfa.**
From Parma, Italy. (Agrost. 2487.)

13745. Medicago sativa. **Alfalfa.**
From Triora, Italy. (Agrost. 2488.)

13746. Trifolium pratense. **Red clover.**
From Triora, Italy. (Agrost. 2489.)

13747. Trifolium pratense. **Red clover.**
From Verona, Italy. (Agrost. 2490.)

13748. Trifolium pratense. **Red clover.**
From Pesaro, Italy. (Agrost. 2491.)

13749. Trifolium pratense. **Red clover.**
From Pairo, Italy. (Agrost. 2492.)

13750. Lotus corniculatus. **Bird's-foot trefoil.**
From Genoa, Italy. (Agrost. 2493.)

13751. Medicago lupulina. **Yellow trefoil.**
From Treviso, Italy. (Agrost. 2494.)

13752. Trifolium pratense. **Red clover.**
From Ferrara, Italy. (Agrost. 2495.)

13753. Medicago sativa. **Alfalfa.**
From Pisa, Italy. (Agrost. 2496.)

13754. Medicago sativa. **Alfalfa.**
From Triora, Italy. (Agrost. 2497.)

13755. Medicago sativa. **Alfalfa.**
From Verona, Italy. (Agrost. 2498.)

13733 to 13794—Continued.

13733 to 13771—Continued.

13756. Trifolium pratense. **Red clover.**
From Treviso, Italy. (Agrost. 2499.)

13757. Medicago sativa. **Alfalfa.**
From Milan, Italy. (Agrost. 2500.)

13758. Medicago sativa. **Alfalfa.**
From Voghera, Italy. (Agrost. 2501.)

13759. Medicago sativa. **Alfalfa.**
From Ales, Italy. (Agrost. 2502.)

13760. Trifolium pratense. **Red clover.**
(No label.) (Agrost. 2503.)

13761. Trifolium pratense. **Red clover.**
(No label.) (Agrost. 2504.)

13762. Medicago denticulata. **Bur clover.**
From Argentina. (Agrost. 2505.)

13763. Trifolium pratense. **Red clover.**
From Argentina. (Agrost. 2506.)

13764. Trifolium incarnatum. **Crimson clover.**
From Argentina. (Agrost. 2507.)

13765. Trifolium hybridum. **Alsike.**
From Argentina. (Agrost. 2508.)

13766. Trifolium pratense. **Red clover.**
From Argentina. (Agrost. 2509.)

13767. Medicago sativa. **Alfalfa.**
From Argentina. (Agrost. 2510.)

13768. Medicago sativa. **Alfalfa.**
From Argentina. (Agrost. 2511.)

13769. Medicago sativa. **Alfalfa.**
From Argentina. (Agrost. 2512.)

13770. Trifolium pratense. **Red clover.**
From Treviso, Italy. (Agrost. 2513.)

13771. Trifolium pratense. **Red clover.**
From Italy. (Agrost. 2514.)

13772 to 13775.

From Reading, England. Received from Sutton & Sons, March, 1903.

13772. Trifolium pratense perenne. **Red clover.**
(Agrost. 2156.)

13773. Trifolium repens perenne. **White clover.**
(Agrost. 2157.)

13774. Trifolium pratense. **Red clover.**
(Agrost. 2158.)

13775. Trifolium hybridum. **Alsike.**
Sutton's giant hybrid cow clover. (Agrost. 2159.)

13776. Trifolium pratense. **Red clover.**

From Reading, England, March 20, 1903. (Agrost. 2162.)

13733 to 13794—Continued.

13777. Trifolium repens. **Wild white clover.**

From Dickson, Chester, England, May 5, 1903. (Agrost. 2179.)

13778. Medicago sativa. **Alfalfa.**

From Missouri Seed Company, 1903. (Agrost. 2180.)

13779. Vicia faba. **Broad bean.**

From Naples, Italy. Collected for World's Fair. (Agrost. 2417.)

13780. Vicia faba. **Broad bean.**

From Italy, 1904. (Agrost. 2418.)

13781. Vicia faba. **Broad bean.**

From Caserta, Italy, 1904. Collected for World's Fair. (Agrost. 2419.)

13782. Vicia faba. **Broad bean.**

From Caserta, Italy, 1904. Collected for World's Fair. (Agrost. 2420.)

13783. Vicia faba. **Broad bean.**

From Italy, 1904. (Agrost. 2421.)

13784. Vicia faba. **Horse bean.**

From Caserta, Italy, 1904. Collected for World's Fair. (Agrost. 2422.)

13785. Vicia faba. **Horse bean.**

From Rome, Italy, 1904. Collected for World's Fair. (Agrost. 2423.)

13786. (Unidentified legume.) (Agrost. 2464.)

13787 to 13793. Brassica napus. **Rape.**

From the Louisiana Purchase Exposition. European varieties.

13787. (Agrost. 2467.)
13788. (Agrost. 2468.)
13789. (Agrost. 2469.)
13790. (Agrost. 2470.)
13791. (Agrost. 2471.)
13792. (Agrost. 2472.)
13793. (Agrost. 2473.)

13794. Onobrychis onobrychis. **Sainfoin.**

From Argentina. (Agros. 2475.)

13795. Bromus inermis. **Smooth brome-grass.**

From Pueblo, Colo. Received thru Keen Bros., April, 1905.

This seed is from a good crop grown under conditions of unusual drought and high temperature. It may therefore be valuable in extending the range of this plant farther south.

13796. Vicia angustifolia (?). **Vetch.**

From Augusta, Ga. Received thru the N. L. Willet Drug Company, April, 1905.

Said to be the most valuable vetch grown in the vicinity of Augusta, Ga.

13797. Lolium bonaerensis.

From Argentina. Received from Argentine exhibit, Louisiana Purchase Exposition, spring of 1905.

13798 to 13800.

From Buitenzorg, Java. Presented by Doctor Treub. Received May 4, 1905.

13798. Nephelium lappaceum. **Rambutan.**

13799. Nephelium mutabile. **Kapoelasan.**

13800. Garcinia mangostana. **Mangosteen.**

13801 and 13802.

From London, England. Received thru James Veitch & Son, April 21, 1905.

13801. ACER MYABEI.

13802. MAGNOLIA STELLATA ROSEA.

13803. AGAPANTHUS UMBELLATUS.

From Berlin, Germany. Received thru L. Spath in 1902.

13804. (Undetermined.)

From Argentina. Received thru Dr. B. T. Galloway in 1902.

Seeds of a tree probably belonging to the family Myrtaceae.

13805. HESPERALOË FUNIFERA.

From Cerritos, Mexico. Received August, 1903. Grown under G. & G. No. 3995 and numbered in May, 1905.

"While the plant is used to a considerable extent for the production of fiber in Mexico, I think it is doubtful whether it could be used for this purpose profitably in this country with our present facilities for cleaning fiber. It is a rather striking ornamental plant, with its large open panicle of pinkish or purplish flowers, followed by pear-shaped, dark-purple seed pods. I would recommend it especially for planting in dry situations in parks and in the Southern States. In the northern part of its range in Mexico it must endure winter temperatures down to zero, and if planted in well-drained soils and protected by a mulch in winter, it will doubtless survive out of doors in the parks of the Southern States." (*Dewey.*)

13806. PSIDIUM GUAJAVA POMIFERUM. **Guava.**

From Argentina. Received thru Dr. B. T. Galloway in 1902. Grown under G. & G. No. 358 and numbered in May, 1905.

13807. HIPPEASTRUM hyb.

From Washington, D. C. Numbered May 7, 1905.

A seedling with double flowers, produced by Mr. G. W. Oliver by crossing.

13808. CINNAMOMUM CAMPHORA. **Camphor.**

From Huntington, Fla. Collected by Mr. W. O. Richtmann, of Drug and Medicinal Plant Investigations, from a tree on the grounds of Dr. George E. Walker, April, 1905.

13809 to 13818.

From Laguna, Cal. Collected by Dr. B. T. Galloway, in the vicinity of Laguna, and sent to Mr. G. W. Oliver for use in breeding. Received May 7, 1905.

13809. MEDICAGO sp.

13810. TRIFOLIUM sp.

13811. LESPEDEZA JAPONICA.

13812. AVENA sp. **Oat.**

"Thousands of acres of this wild oat are being harvested for hay. Good thing for hybridizing. Grown on soil with 10 inches of rain. Cuts 4 to 5 tons per acre." (*Galloway.*)

13813. (Undetermined.) **Grass.**

13814. (Undetermined.) **Grass.**

13815. (Undetermined.) **Grass.**

13816. ECHINOCYSTIS sp. (No. 1.)

13817. ECHINOCYSTIS sp. (No. 2.)

13818. BLOOMERIA AUREA.

13819 to 13851. DIOSPYROS KAKI. **Japanese persimmon.**

A collection of plants of named varieties secured for the use of Mr. G. W. Oliver in breeding work. Received in January, 1905.

13819 to 13820.

Received thru the P. J. Berckmans Company, Augusta, Ga.

13819. *Maru gata.*
13820. *Miye tan.*

13821 to 13825.

Received thru the Fancher Creek Nurseries, Fresno, Cal.

13821. *Dai-dai maru.*
13822. *Goshi gaki.*
13823. *Hachiya.*
13824. *Tsuro noko.*
13825. *Yemon.*

13826 to 13834.

Received thru Mr. G. L. Taber, Glen St. Mary, Fla.

13826. *Costata.*
13827. *Okame.*
13828. *Taber's No. 23.*
13829. *Taber's No. 129.*
13830. *Tane nashi.*
13831. *Triumph.*
13832. *Tsuru.*
13833. *Yeddo ichi.*
13834. *Zengi.*

13835 to 13851.

Received thru the Yokohama Nursery Company, Yokohama, Japan.

13835. *Dai-dai maru.*
13836. *Daitsurumoko.*
13837. *Giboshi.*
13838. *Gosho.*
13839. *Hachiya.*
13840. *Kozuru.*
13841. *Kuro kuma.*
13842. *Mamegaki.*
13843. *Minozuru.*
13844. *Mushirazu.*
13845. *Mizigaki.*
13846. *Shakumi.*
13847. *Shibuyemon.*
13848. *Tane nashi.*
13849. *Zenji maru.*
13850. (Unnamed.)
13851. (Unnamed.)

13852. CEPHALARIA TATARICA.

From New York, N. Y. Received thru J. M. Thorburn & Co., May 5, 1905.

13853. TRIFOLIUM REPENS. **White clover.**

From Paris, France. Received thru Vilmorin-Andrieux & Co., May 6, 1905.

White Lodino. "This is a giant form of white clover from the Po Valley, truly perennial, hardy, tall (2 feet), recovering more quickly than other clovers after cutting. Not adapted to light, sandy, or poor soil, but gives 3 to 4 cuttings; 4 to 5 tons of hay on rich soil." (*Vilmorin-Andrieux & Co.*)

13854 to 13856. TRITICUM DURUM. **Macaroni wheat.**

From North Platte, Nebr. Received April 29, 1905.

Macaroni wheats grown by the Nebraska Experiment Station from imported seed.

13854. *Yellow Gharnovka.*
13855. *Black Don.*
13856. *Velvet Don.*

13857 and 13858. MEDICAGO SATIVA. **Alfalfa.**

From Paris, France. Received thru Vilmorin-Andrieux & Co., May 8, 1905.

13857. From Simbirsk, Russia.
13858. From Kharkof, Russia.

13859. ALLIUM CEPA. **Onion.**

From Paris, France. Presented by Vilmorin-Andrieux & Co. Received May 6, 1905.

Sainte Marie. "This onion is remarkable for its great earliness. It is flat in shape, with a very fine neck, and produces, as quickly as the *White Queen* onion, marketable bulbs of a larger size than those of the latter. It seems to us that it might be a desirable variety for truck farmers in the Southern States." (*Vilmorin-Andrieux & Co.*)

13860. STIPA TENACISSIMA. **Esparto grass.**

From Office of Grass and Forage Plant Investigations. Received May 9, 1905. Originally from J. M. Thorburn & Co., New York, N. Y. (Agrost. No. 2216.)

13861. NEPHELIUM MUTABILE. **Kapoelasan.**

From Buitenzorg, Java. Presented by Doctor Treub. Received May 12, 1905.

13862. CLITORIA TERNATEA (?) **Butterfly pea.**

From Porto Rico. Grown from seed presented by the Governor. Plants numbered May 6, 1905.

13863. CLEMATIS DAVIDIANA. **Clematis.**

From Philadelphia, Pa. Received thru Henry A. Dreer, Incorporated, May 6, 1905.

13864. HYDRASTIS CANADENSIS. **Golden-seal.**

From Mantua, Ohio. Received thru Mr. A. W. Russel, at the request of Mr. W. W. Stockberger, May 15, 1905. Seed for use in connection with experiments being carried on by Dr. R. H. True.

13865 to 13924.

From Pretoria, South Africa. Presented by Mr. G. Baylis, Division of Botany, Transvaal Department of Agriculture, thru Prof. W. J. Spillman. Received May 1, 1905.

A collection of native grass seeds as follows (the numbers in parentheses are Mr. Baylis's):

13865. (Natal redtop.) (239/05.)

13866. (Native grass.) (240/05.)

13867. ERAGROSTIS sp. (241/05.)

13868. ERAGROSTIS sp. (242/05.)

13869. (Native grass.) (243/05.)

13870. (Native grass.) (244/05.)

13871. ERAGROSTIS CHLOROMELAS. (245/05.)

13872. (Native grass.) (247/05.)

13873. ANDROPOGON CONTORTUS. (248/05.)

13874. (Native grass.) (249/05.)

13875. ERAGROSTIS sp. (250/05.)

13876. ERAGROSTIS sp. (251/05.)

13877. AGROSTIS sp. (252/05.)

13878. CAPRIOLA DACTYLON (253/05.)

13879. ARISTIDA sp. (254/05.)

13880. ANDROPOGON sp. (255/05.)

13881. ELIONURUS ARGENTENUS. (256/05.)

13882. ANDROPOGON sp. (257/05.)

13883. ERAGROSTIS PLANA. (258/05.)

13884. ERAGROSTIS LAPPULA DIVARICULA. (259/05.)

13885. ERAGROSTIS sp. (260/05.)

13865 to 13924—Continued.

13886. Arundinella ecklonii. (261/05.)

13887. Chaetochloa sp. (262/05.)

13888. (Native grass.) (263/05.)

13889. Andropogon eucomus. (264/05.)

13890. (Native grass.) (265/05.)

13891. (Native grass.) (277/05.)

13892. Aristida sp. (278/05.)

13893. Tricholaena rosea. (279/05.)

13894. Panicum colonum. (281/05.)

13895. Chloris virgata. (282/05.)

13896. Eragrostis sp. (285/05.)

13897. Eragrostis sp. (286/05.)

13898. (Native grass.) (287/05.)

13899. Aristida sp. (288/05.)

13900. Eragrostis sp. (289/05.)

13901. Chloris virgata. (290/05.)

13902. (Native grass.) (291/05.)

13903. (Native grass.) (292/05.)

13904. Eragrostis sp. (293/05.)

13905. (Native grass.) (294/05.)

13906. Eragrostis sp. (295/05.)

13907. (Native grass.) (296/05.)

13908. (Native grass.) (297/05.)

13909. (Native grass.) (298/05.)

13910. Chaetochloa aurea. (299/05.)

13911. Chaetochloa sp. (300/05.)

13912. Chaetochloa nigrirostre (?) (301/05.)

13913. Panicum isachne. (302/05.)

13914. Chaetochloa pennisetum (?) (303/05.)

13915. (Native grass.) (305/05.)

13916. (Native grass.) (306/05.)

13917. (Native grass.) (307/05.)

13918. (Native grass.) (308/05.)

13919. Chaetochloa sp. (309/05.)

13920. (Native grass.) (310/05.)

13921. Eragrostis major megastachya. (311/05.)

13922. Paniculum sulcatum. (312/05.)

13923. (Native grass.) (313/05.)

13924. (Native grass.) (315/05.)

13925 to 13946. CLEMATIS spp. **Clematis.**

From Philadelphia, Pa. Received thru Henry A. Dreer, Incorporated, May 6, 1905.

13925. Clematis flammula (*Rubra marginata*).

13926. Clematis indivisa.

13927. Clematis coccinea.

13928 to 13945. Clematis spp.

13928. *Anderson Henryi.*

13929. *Boskoop Seedling.*

13930. *Fairy Queen.*

13931. *Duchess of Edinburgh.*

13932. *Gipsy Queen.*

13933. *Jackmani.*

13934. *Jackmani Superba.*

13935. *Lilacina Floribunda.*

13925 to 13946—Continued.

13928 to 13945—Continued.

13936. *M. Koster.*

13937. *Mme. Baron Veillard.*

13938. *Mme. Van Houtte.*

13939. *Miss Bateman.*

13940. *Standishi.*

13941. *The Gem.*

13942. *The President.*

13943. *Countess of Onslow.*

13944. *Duchess of Albany.*

13945. *Duchess of York.*

13946. CLEMATIS INTEGRIFOLIA DURANDII.

13947 to 13949. PHALARIS CANARIENSIS. **Canary grass.**

From Monte, Grand Canary. Presented by Mr. Alaricus Delmard, Hotel Santa Brigada. Received April 24, 1905.

"*Phalaris canariensis*, as a matter of fact, is hardly grown in the islands and mostly comes from the Province of Alicante, in Spain. But one person grows it here, and I will forward you a packet of the seed. Again I regret that I can only discover one variety as grown here. It may have been grown as a crop for the sale of seed in former times in these islands, but certainly is so no longer. The seed I now have comes from Morocco and Buenos Aires, and also from Seville; that from the former two places costs 62 pesetas for 100 kilos, and from Seville 65 pesetas." (*Delmard.*)

13947. Grown in Buenos Aires.

13948. Grown in Morocco.

13949. Grown in Monte.

13950 and 13951. PHALARIS spp.

From San Giovanni a Teduccio, Italy. Received thru Dammann & Co., April 25, 1905.

13950. PHALARIS CANARIENSIS. **Canary grass.**

13951. PHALARIS ARUNDINACEA. **Reed canary grass.**

13952 to 13966. BETA VULGARIS. **Sugar beet.**

Sugar-beet seeds planted at Fairfield, Wash., in the spring of 1905, by Mr. Joseph F. Reed, assistant in sugar-beet experiments, from selected roots.

13952. *Kleinwanzleben;* tested 23 per cent sugar.

Roots selected from Mr. E. H. Morrison's general stock in 1903. Seed raised in 1904.

13953. *Kleinwanzleben;* tested 23 per cent sugar.

Roots selected from No. 12846 (Lehi seed) in 1903. Seed raised in 1904.

13954. *Kleinwanzleben;* tested 22 per cent.

Roots selected from Mr. E. H. Morrison's general stock in 1903.

13955. *Kleinwanzleben;* tested 21 per cent.

Roots selected from Mr. E. H. Morrison's general stock in 1903.

13956. *Kleinwanzleben;* tested 20 per cent.

Roots selected from Mr. E. H. Morrison's general stock in 1903.

13957. *Kleinwanzleben;* tested 19 per cent.

Roots selected from Mr. E. H. Morrison's general stock in 1903.

13958. *Kleinwanzleben;* tested 19 per cent.

Roots selected from No. 12846 (Lehi seed) in 1903.

13959. *Kleinwanzleben;* tested 18 per cent.

Roots selected from Mr. E. H. Morrison's general stock in 1903.

13952 to 13966—Continued.

13960. *Kleinwanzleben;* tested 18 per cent.

Roots selected from No. 12849 (Morrison seed), 1903.

13961. *Kleinwanzleben;* tested 18 per cent.

Roots selected from No. 12846 (Lehi seed) in 1903.

13962. *Kleinwanzleben;* tested 17 per cent.

Roots selected from Mr. E. H. Morrison's general stock in 1903.

13963. *Kleinwanzleben;* tested 16 per cent.

Roots selected from Mr. E. H. Morrison's general stock in 1903.

13964. *Dippe Elite Kleinwanzleben;* tested 16 per cent.

Roots selected from *Dippe Kleinwanzleben,* 1903.

13965. *Kleinwanzleben;* tested 15 per cent.

Roots selected from Mr. E. H. Morrison's general stock in 1903.

13966. *Kleinwanzleben;* tested 15 per cent.

Roots selected from Mr. E. H. Morrison's general stock in 1903. The outside seed stalks were cut out, allowing more nourishment to the stalks produced from the inner or sugar rings of the beet.

13967. CARISSA ARDUINA. **Amatungulu.**

From Cape Town, South Africa. Presented by Prof. P. MacOwan, government botanist, Department of Agriculture, Cape of Good Hope. Received April 24, 1905.

"A handsome apocynaceous shrub which may make an ornamental hedge plant in your Southern States. The glittering green of the foliage and the curious rectangular mode of branching catch the eye, but, like some other African Sepiariae, it requires the severest discipline with the shears, and, I must say, submits to it well.

"Even the Apple-of-the-Kei, now spread over the warmer world, is not more destined to the steel than is this Carissa. The flowers are borne in small umbels, brilliantly white, scented, and succeeded by lots of scarlet ovoid fruits, the beloved 'num-nums' of natives and kids generally. I hope you will push it into notice among amateurs. They can make cones or pyramids of it, if they like, in the antique topiary fashion." (*MacOwan.*)

13968 to 13975.

From Pretoria, Transvaal, South Africa. Presented by Prof. J. Burtt Davy, government agrostologist and botanist, Transvaal Department of Agriculture. Received May 15, 1905.

"Small samples of local varieties of wheat, oats, Nepaul barley, and maize. For your guidance in their disposal I may say that this is a region of hot days and cool nights (frosty in winter), with summer rains, and a long, cool, rainless winter. The rainfall runs from 20 to 30 inches, but is discounted by six or seven months of practical drought." (*Davy.*)

13968. AVENA sp. **Oat.**

Boer. (283/05.)

13969. HORDEUM sp. **Barley.**

Tibet. (217/05.)

13970. ZEA MAYS. **Corn.**

Egyptian. (990/04.)

13971. ZEA MAYS. **Corn.**

North American. (992/04.)

13968 to 13975—Continued.

13972. ZEA MAYS. **Corn.**

White Botman Mealie. (694/04.)

13973. TRITICUM VULGARE. **Wheat.**

Klein Koren. (284/05.)

13974. TRITICUM VULGARE. **Wheat.**

Tibet. (216/05.)

13975. TRITICUM VULGARE. **Wheat.**

Wol Koorn. (498/04.)

13976 to 13985. BERBERIS sp. **Barberry.**

From St. Petersburg, Russia. Presented by Messrs. Regel and Kesselring, of the Royal Botanical Gardens. Received May 11, 1905.

13976. BERBERIS SINENSIS.

13977. BERBERIS THUNBERGII MAXIMOWICZI.

13978. BERBERIS THUNBERGII.

13979. BERBERIS VULGARIS.

13980. BERBERIS VULGARIS SULCATA.

13981. BERBERIS VULGARIS AMURENSIS.

13982. BERBERIS VULGARIS EMARGINATA.

13983. BERBERIS VULGARIS MACROCARPA.

13984. BERBERIS VULGARIS PURPUREA.

13985. BERBERIS VULGARIS SPATHULATA.

13986 to 13988.

From Buitenzorg, Java. Received thru Doctor Treub, May 20, 1905.

13986. LANSIUM DOMESTICUM. **Doekoe.**

13987. GARCINIA MANGOSTANA. **Mangosteen.**

13988. NEPHELIUM MUTABILE. **Kapoelasan.**

13989 to 13992.

From New York, N. Y. Received thru J. M. Thorburn & Co., May 12, 1905.

13989. HEDYSARUM CORONARIUM. **Sulla.**

13990. ORNITHOPUS SATIVUS. **Serradella.**

13991. ONOBRYCHIS ONOBRYCHIS. **Sainfoin.**

13992. PISUM ARVENSE. **Canada field pea.**

13993 to 13998.

From Westbury Station, Nassau County, N. Y. Received thru Isaac Hicks & Son, May 25, 1905.

Ornamental plants as follows:

13993. ACER CARPINIFOLIUM.

13994. CORNUS MACROPHYLLA.

13995. CORNUS MACROPHYLLA.

13996. VIBURNUM DILATATUM.

13997. QUERCUS CUSPIDATA.

13998. STUARTIA PSEUDOCAMELLIA.

13999. MEDICAGO SATIVA. **Alfalfa.**

From Ogden, Utah. Received thru Mr. P. A. Nebeker, May 23, 1905.

Turkestan alfalfa, grown on unirrigated land from imported seed (probably S. P. I. No. 991) furnished Mr. Nebeker in 1900.

14000 to 14005. GLADIOLUS spp. **Gladiolus.**

From New York, N. Y. Received from Mr. W. Van Fleet, April 5, 1905.

14000. GLADIOLUS CRUENTUS.

14001. GLADIOLUS PURPUREO-AURATUS.

14002. GLADIOLUS DRACOCEPHALUS.

14003. GLADIOLUS PSITTACINUS.

14004. GLADIOLUS SAUNDERSII.

14005. GLADIOLUS LEICHTLINI.

14006 to 14072. GLADIOLUS spp. **Gladiolus.**

From Floral Park, N. Y. Received thru Mr. John Lewis Childs, April 8, 1905.

14006 to 14034. GLADIOLUS CHILDSII.

14035 to 14061. GLADIOLUS GANDAVENSIS.

14062 to 14072. GLADIOLUS LEMOINEI.

14073 to 14087. GLADIOLUS spp. **Gladiolus.**

From Berlin, N. Y. Received thru Mr. Arthur Cowee, April 12, 1905.

14088 to 14155. GLADIOLUS spp. **Gladiolus.**

From Nancy, France. Received thru V. Lemoine & Son, May 4, 1905.

14156 to 14259. GLADIOLUS spp. **Gladiolus.**

From Paris, France. Received thru Vilmorin-Andrieux & Co., May 10, 1905.

14260 to 14267. GLADIOLUS spp. **Gladiolus.**

From Erfurt, Germany. Received thru Haage & Schmidt, May 10, 1905.

14268 to 14412. GLADIOLUS spp. **Gladiolus.**

From Somerset, England. Received thru Kelway & Sons, Langport, May 12, 1905.

(See the circular of the Bureau of Plant Industry entitled "A Variety Collection of Gladiolus," 1905.)

14413 to 14418.

From Sultepec, Mexico. Presented by Mr. Federico Chisolm. Received May 12, 1905.

A small collection of unidentified plants.

14419. TULIPA sp. **Tulip.**

From Dedham, Mass. Received thru Mr. A. W. Cheever, August 25, 1905.

14420 and 14421. NICOTIANA TABACUM. **Tobacco.**

From Sao Paulo, Brazil. Presented by Dr. H. M. Lane, Mackenzie College. Received May 25, 1905.

14420. *Fumo Creolo.* Seed from near Cotia, State of Sao Paulo, Brazil.

14421. Seed from Pirassununga, State of Sao Paulo, Brazil.

14422 to 14431.

From Honolulu, Hawaii. Presented by Mr. Ralph S. Hosmer, superintendent of forestry, Hawaiian Bureau of Agriculture and Forestry. Received May 31, 1905.

14422. RAUWOLFIA SANDWINCENSIS.

Native name *Hao.* A small, milky tree.

14422 to 14431—Continued.

14423. CHEIRODENDRON GAUDICHAUDII.

Native name *Olapa.* A tree 30 to 50 feet high. The natives prepare a blue dye from the bark and leaves.

14424. MABA SANDWICENSIS.

Native name *Lama.* Grows to a height of from 20 to 40 feet.

14425. CAESALPINIA KAUAIENSIS.

Native name *Uhiuhi.* A low shrub 3 to 4 fee

14426. ERYTHRINA MONOSPERMA.

Native name *Wiliwili.* An ornamental tree 20 to 25 feet high, with short, thick trunk and spreading crown. The tree loses its leaves in late summer, and in the spring before the new leaves are out scarlet flowers appear. The wood is soft and corklike.

14427. DRACAENA AUREA.

Native name *Halapepe.* A glabrous tree 20 to 25 feet high, from the wood of which the natives used to carve their idols.

14428. MYRSINE LASSERTIANA.

Native name *Kolea.* A tree 20 to 50 feet high. The natives used to extract a red dye from the bark.

14429. ALPHITONIA PONDEROSA.

Native name *Kauwila.* A tall tree, often attaining 50 to 83 feet. The wood is remarkable for close grain, hardness, and heavy weight, on which account the natives preferred it for making spears, mallets for beating kapa, and other tools; turns black with age.

14430. DODONAEA VISCOSA.

Native name *Aalii.*

14431. MYOPORUM SANDWICENSIS.

"Native name *Naeo.* English name 'bastard sandalwood.' Tree 20 to 30 feet high. The wood of this tree, most so the roots, becomes fragrant on drying, with an odor resembling that of sandalwood, whence its English name. After the exhaustion of the true sandalwood it was exported for some time to China as a substitute." (*Hillebrand.*)

14432. GERBERA JAMESONI. **Barberton daisy.**

From Lourenço Marquez, East Africa. Presented by Mr. A. E. Graham-Lawrence, thru Hon. W. Stanley Hollis, United States consul. Received July 14, 1905.

14433. (Undetermined.) **"Lemoncito."**

From Manila, P. I. Received thru Capt. George P. Ahern, chief of the Bureau of Forestry, Manila Bureau of Agriculture, July 17, 1905.

"This is a small plant, the height of which does not exceed one and one-half of that of a man, and is known only by the name of 'lemoncito.' It usually has about five very leafy branches. Its trunk is nearly 20 centimeters in diameter, of a light-yellow color, with blackish spots hardly perceptible, and of a fine fibrous texture. It is not very well known by the common people. Its branches are slender and produce leaves in groups of three, the middle one being the largest; in the growth of the leaves are found thorns somewhat pronounced; the groups of leaves are arranged in alternating order on either side of the branch up to the end. Its trunk has no odor, but its fruit has an agreeable odor somewhat like maraschino. They appear between the groups of leaves at the time of opening of the calyx of a flower from which they come, and are sometimes found in clusters and sometimes single. In the month of May this plant produces fruit in abundance and they ripen in a few days.

They have an oval form with a pronounced fiery color, are aromatic and edible with a somewhat acrid yet sweet taste.

"Commonly people who have lemoncito trees make sirup from the ripened fruit and also preserve them." (*Ahern.*)

14434 to 14463.

From Mexico. Secured by Prof. P. H. Rolfs, in charge of the Subtropical Laboratory, Miami, Fla., while traveling in Mexico as agricultural explorer of the Office of Seed and Plant Introduction in April, May, and June, 1905.

14434. PRUNUS sp. **"Ceruella."**

"A form of native Prunus, resembling the peach in color, about the size of a damson plum. Secured at Jalapa, Mexico. This plum grows in that neighborhood; consequently it is possible that seedlings from it will be able to maintain themselves in extreme southern Florida and Porto Rico. (Lab. No. 289.)" (*Rolfs.*)

14435. PERSEA GRATISSIMA. **Avocado.**

"A small quantity of bud wood secured from a tree that blooms in January and ripens fruit in May. The special value of this particular tree lies in the fact that it ripens in so short a time after blooming. The fruit, altho delicious and otherwise good, is too small to prove of value on the market. Its special value, however, lies in the fact that when it comes into bearing it can be used for hybridizing with the early forms that do have marketable fruit, and consequently the introduction is very desirable. (Lab. No. 295.)" (*Rolfs.*)

14436. CUCURBITA sp. **Squash.**

"This is a peculiar native (?) squash that is grown to some extent for the market, and it is possible that it would be of use in the Southern States for a summer vegetable on account of its extremely hard outer skin. (Lab. No. 296.)" (*Rolfs.*)

14437. CAESALPINIA sp.

"This is a flowering shrub found at Papantla, State of Vera Cruz. It resembles to some extent a plant already grown in Florida and known as the *dwarf Poinciana* (*Caesalpina pulcherrima*). It differs from this, however, in producing a much greater abundance of flowers and growing about twice the height. It is a distinct species from that mentioned. (Lab. No. 297.)" (*Rolfs.*)

14438. FICUS sp.

"A number of ripe fruits of this tree were secured from the public garden at Papantla. The fruits are about the size of black walnuts, and are inedible, tho not of unpleasant flavor; but the tree is very decorative. In general character of the tree and look of the leaves, this species would classify near *Ficus carica.* (Lab. No. 298.)" (*Rolfs.*)

14439. HIBISCUS sp.

"An Hibiscus that appears to be a native, bearing a very dark maroon-colored bloom. Quite showy and striking. (Lab. No. 299.)" (*Rolfs.*)

14440. VANILLA sp. **"Pompon."**

"This species is a very strong-growing vanilla. Produces the largest pods and in considerable quantity. Secured near Papantla, Vera Cruz. (Lab. No. 308.)" (*Rolfs.*)

14441. VANILLA PLANIFOLIA (?). **Vanilla.**

"This number appears to be the true *V. planifolia*, but could not be identified. It, however, is one of the vanilla-producing species. (Lab. No. 309.)" (*Rolfs.*)

14442. VANILLA PLANIFOLIA. **Vanilla.**

"This was secured from a vanillary some 10 or 12 miles from Papantla. It is probably the true *V. planifolia.* It is from this species that most of the commercial material is produced in this section. (Lab. No. 310.)" (*Rolfs.*)

14434 to 14463—Continued.

14443. VANILLA sp. **Vanilla.**

"The exact status of this number can not be learned until the flowers and fruit shall have been studied. It is, however, not *V. planifolia*. (Lab. No. 311.)" (*Rolfs.*)

14444. VANILLA sp. **Vanilla.**

"This is rather a weak-growing species of the vanilla genus, but I have been told that it produces beans of unusual strength. Secured on the Isthmus of Tehuantepec. (Lab. No. 312.)" (*Rolfs.*)

14445. VANILLA sp. **Vanilla.**

"This is a very narrow-leaved species. It is not a vigorous grower, but is said to be of considerable value. Secured on the Isthmus of Tehuantepec. (Lab. No. 313.)" (*Rolfs.*)

14446. VANILLA sp. **Vanilla.**

"Quite similar to 313 and may prove to be the same species, but in the field it showed considerable difference, due to the place where it was growing. Secured on the Isthmus of Tehuantepec. (Lab. No. 314.)" (*Rolfs.*)

14447. BAMBUSA VULGARIS (?). **Bamboo.**

"This gigantic-growing bamboo was seen all along the way from a few miles below Teziutlan to Papantla. It has become rather thoroly established, and would appear to be a native of this region. A small quantity of good seed was obtained from fruiting specimens. (Lab. No. 316.)" (*Rolfs.*)

14448. MANGIFERA INDICA. **Mango.**

"Seed of what is commonly called *Manila* mango. This is probably the same mango that is called the *Philippine* mango in Cuba. Very little fiber. Fruit very long, about 5 inches, sometimes longer than this, about 3 inches broad at its broadest, about 1½ to 2 inches thick. Delicious flavor, free from turpentine, and the best varieties can be eaten with a spoon, it being possible to cut the fiber with an ordinary teaspoon. (Lab. No. 317.)" (*Rolfs.*)

14449. CARICA PAPAYA. **Papaw.**

"A very handsome specimen of this fruit was purchased for the seed. (Lab. No. 318.)" (*Rolfs.*)

14450. CASTILLA ELASTICA. **Rubber.**

(Lab. No. 319.)

14451. LYCOPERSICUM ESCULENTUM. **Tomato.**

"A small tomato, which is said to be a native of Mexico and one that occurs very commonly, especially on the Isthmus of Tehuantepec. (Lab. No. 320.)" (*Rolfs.*)

14452. ANANAS SATIVUS. **Pineapple.**

"Known as the *Guatemala Spineless White*. This variety has a number of points that would commend it for our use—spineless, ripens early, is delicious, and apparently a good shipper. (Lab. No. 323.)" (*Rolfs.*)

14453. CICER ARIETINUM. **Chick-pea.**

"This is a legume which in some respects resembles the English pea, and is used very largely in preparing soups and dishes of that kind. It is not generally used in this country, but if it should prove to do well the Spanish market would use all that could be furnished for some time. (Lab. No. 327.)" (*Rolfs.*)

14454. CASIMIROA EDULIS. **White sapota.**

(Lab. No. 328.)

14455. **"Haba."**

"A legume to be found on most of the markets. (Lab. No. 329.)" (*Rolfs.*)

14434 to 14463—Continued.

14456. PRUNUS sp. **"Ceruella."**

"This species is said to be a native of Mexico and to grow very luxuriantly in the regions where oranges are produced. If this could be grown in Florida and Porto Rico it would be a very desirable acquisition. (Lab. No. 331.)" (*Rolfs.*)

14457. MUSA ENSETE.

"Seed secured in Mexico City. (Lab. No. 332.)" (*Rolfs.*)

14458. BACTRIS MAJOR. **Palm.**

"Very ornamental palm from the Isthmus of Tehuantepec. (Lab. No. 333.)" (*Rolfs.*)

14459. ZEA MAYS. **Corn.**

"Corn that grows along the Isthmus of Tehuantepec. It has some qualities that may adapt it for growth in the extreme southern part of the United States. (Lab. No. 334.)" (*Rolfs.*)

14460. **"Haba."**

"Seed of another species of legume, which occurs commonly on the various markets in Cuba. (Lab. No. 335.)" (*Rolfs.*)

14461. **"Bayo."**

"Seed of another legume. Secured in the Vera Cruz market. (Lab. No. 337.)" (*Rolfs.*)

14462. ERVUM LENS. **Lentil.**

"Appears to be a lentil, as grown in Europe. Secured in the Vera Cruz market. (Lab. No. 338.)" (*Rolfs.*)

14463.

"Seed of the tree referred to under 'No. 295.' (Lab. No. 339.)" (*Rolfs.*)

14464. CINNAMOMUM CAMPHORA. **Camphor.**

This number (14464) was assigned to camphor plants distributed by Mr. E. M. Byrnes, superintendent of gardens and grounds, in order to keep a record of the distribution.

The seeds from which the plants were grown came from various sources.

14465. ZEA MAYS. **Corn.**

From Houston, Tex. Received thru Dr. S. A. Knapp, July 14, 1905.

Laguna. Secured by Doctor Knapp from Mexico. "This is a new variety. Was grown in Texas. In the latitude of north Texas this could be planted as late as the first of August." (*Knapp.*)

14466. TRIFOLIUM INCARNATUM. **Crimson clover.**

From Richmond, Va. Received thru T. W. Wood & Son, July 20, 1905.

Late.

14467. VICIA VILLOSA. **Hairy vetch.**

From Richmond, Va. Received thru T. W. Wood & Son, July 20, 1905.

14468. VICIA FABA. **Horse bean.**

From Montreal, Canada. Received thru William Ewing & Co., July 20, 1905.

14469. GOSSYPIUM sp. **Cotton.**

From Chicago, Ill. Received thru Mr. I. L. Hauser (?), 225 Dearborn street, July 17, 1905.

14470. ERAGROSTIS ABYSSINICA. **Teff.**

From San Giovanni a Teduccio, near Naples, Italy. Received thru Dammann & Co., July 21, 1905.

14471. XANTHOSOMA SAGITTIFOLIUM. **Yautia.**

From Mayaguez, P. R. Received from the Agricultural Experiment Station, July 24, 1905.

"This variety is in many respects the best of all the yautias cultivated in tropical America. It yields 3 to 5 pounds to the hill, and can be grown on a great variety of soils. It requires about ten months to mature.

"This variety is known as '*Rolliza*' in Porto Rico. It is also grown in Trinidad, Venezuela, and Balize, British Honduras. The fresh roots contain 20 per cent to 28 per cent of starch, with very little fiber. 'No. 1,' of P. R. Exp. Station." (*Barrett.*)

14472 and 14473.

From Manila, P. I. Received thru Capt. George P. Ahern, chief of the Bureau of Forestry, July 24, 1905.

14472. ORANIA PHILIPPINENSIS. **Palm.**

"A palm indigenous to the Philippine Islands." (*Ahern*)

14473. PANDANUS LUZONENSIS.

"A plant indigenous to the Philippine Islands, found at elevations up to 600 meters above sea level. Apparently closely related to *Pandanus sylvestris* Bory, from the island of Reunion, differing in its larger size, longer leaves, etc. Described in Bulletin No. 17, Bureau of Government Laboratories, Manila, P. I., 'New or Noteworthy Philippine Plants, II,' by Botanist Elmer D. Merrill." (*Ahern.*)

14474. VIGNA SINENSIS. **Cowpea.**

From Grovetown, Ga. Received thru Mr. W. W. Hamilton, July 26, 1905.

14475. SOLANUM COMMERSONI. **Aquatic potato.**

From Montevideo, Uruguay. Received thru Dr. J. Clyde Macartney, July 25, 1905.

14476. OPUNTIA sp. **Prickly pear.**

This number (14476) was assigned to about 500 seedling cacti sent by Mr. Luther Burbank, Santa Rosa, Cal., to Dr. S. A. Knapp, San Antonio, Tex., for planting on the Government demonstration farm.

14477 to 14479.

From City of Mexico, Mexico. Received thru Dr. J. N. Rose, of the United States National Museum, July 28, 1905.

A collection of unidentified plants.

14480. IPOMOEA BATATAS (?). **Dahomey sweet potato.**

From Bordeaux, France. Received thru Hon. Albion W. Tourgee, United States consul, July 31, 1905.

This plant "is a native of Dahomey and very prolific. The leaves of the plant can be used as a substitute for spinach, and the tubers, containing a higher percentage of sugar than beets, are fine flavored and make exceptionally good food for live stock." (*Tourgee.*)

14481. LILIUM LONGIFLORUM EXIMEUM. **Easter lily.**

From Washington, D. C. Received July 31, 1905. Selected bulbs grown in the Department greenhouses.

14482. JUNCUS EFFUSUS. **Matting rush.**

From California. Collected under the direction of Prof. A. V. Stubenrauch. Roots secured from California marshes for work on the matting-rush industry.

14483. CYPERUS sp.

From Kobe, Japan. Received thru Mr. A. G. Boyer, at North Galveston, Tex., April, 1904.

14484 and 14485. CAPSICUM ANNUUM. **Pepper.**

From Malaga, Spain. Received thru Hon. D. R. Birch, United States consul, July 31, 1905.

14484. *Chile.* **14485.** *Large red sweet coin.*

"This pepper is the most common variety on sale here, and the fruits are usually about 8 inches in length." (*Birch.*)

14486. SCHOENOCAULON OFFICINALE (?). **"Cebadilla."**

From San Luis Potosi, Mexico. Received thru Dr. Edward Palmer from Dr. Gregorio Borroeta, July 31, 1905.

An insecticide wash for cattle infected with ticks is said to be prepared from these plants. Related to the fly-killer (*Amiranthium muscaetoxicum*) and to the green hellebore (*Veratrum*). Imported for experiments in Cuba.

14487. PRUNUS SIBIRICA. **Siberian apricot.**

From Jamaica Plain, Mass. Received thru the Arnold Arboretum, July 28, 1905.

This variety is said to be perfectly hardy in Massachusetts.

14488. BIDENS HETEROPHYLLA. **"Malpe" tea.**

From Guadalajara, Mexico. Received thru Mr. Federico Chisolm, August 1, 1905.

"A great part of the stuff sold as 'tea' in Mexico is the rolled leaves of this plant." (*Chisolm.*)

14489. (Undetermined.)

From Tacoma, Wash. Presented by Gen. William G. Le Duc. Received July 27, 1905.

"Plant said to be used by the Indians as a cure for 'mountain fever;' fruits are edible." (*Le Duc.*)

14490. SOLANUM TUBEROSUM. **Potato.**

From Edinburgh, Scotland. Secured by Prof. L. R. Jones, of the Vermont Experiment Station, from T. A. Scarlett, and sent direct to Burlington, Vt.

El Dorado. "A potato that is of peculiar prominence for disease resistance. In 1904 speculation forced the price as high as $16 a pound." (*Jones.*) (See No. 13034.)

14491. NARCISSUS POETICUS ALBA fl. pl.

From Edinburgh, Scotland. Received thru the Royal Botanical Gardens, August 7, 1905.

14492. PANICUM MAXIMUM. **Guinea grass.**

From Australia. Received thru J. M. Thorburn & Co., New York, N. Y., May 25, 1905.

14493 to 14497.

From Paris, France. Received thru Vilmorin-Andrieux & Co., May 26, 1905.

Clover and alfalfa seeds:

14493. TRIFOLIUM PRATENSE. **Red clover.**

Trefle, violet de Russie.

14494. TRIFOLIUM INCARNATUM. **Crimson clover.**

Trefle, incarnat de Russie.

14495. TRIFOLIUM REPENS. **White clover.**

Trefle, blanc de Russie.

14496. MEDICAGO SATIVA. **Alfalfa.**

Luzerne de Pensa (Simbirsk).

14497. MEDICAGO SATIVA. **Alfalfa.**

Luzerne de Charkow.

14498. PERSEA INDICA.

From Monte, Grand Canary. Presented by Mr. Alaricus Delmard. Received June 1, 1905.

Seeds from Teneriffe. "Procured for the purpose of growing stocks upon which to graft seedling avocado (*Persea gratissima*) for planting in localities which require a more hardy stock than the latter." (*Fairchild.*)

14499. VIGNA SINENSIS. Cowpea.

From Richmond, Va. Received thru T. W. Wood & Sons, June 1, 1905.

Wonderful.

14500 to 14775. ANDROPOGON SORGHUM. Sorghum.

From Bombay Presidency, India. Received by the Office of Grass and Forage Plant Investigations, April 27, 1903, from Hon. J. W. Mollison, Inspector-General of Agriculture in India. Turned over to the Office of Seed and Plant Introduction and numbered in the spring of 1905.

A collection of sorghums obtained from Surat Farm, Bombay Presidency.

14500. *Dharla* (A).
14501. *Kar Juar.*
14502. *Garia Yellow.*
14503. *Ellichpuri.*
14504. *Gare.*
14505. *Akada.*
14506. *Garia Yellow* (A).
14507. *Yellaspuri.*
14508. *Kalbondi.*
14509. *Dharla.*
14510. (Variety from Sampgaon.)
14511. *Akada* (A).
14512. *Sadagar.*
14513. *Kar Juar* (A).
14514. *Patasi.*
14515. *Nirmali.*
14516. *Gare Nasik.*
14517. *Akada* (B).
14518. *Akada* (C).
14519. *Gangad.*
14520. *Garia Dharla.*
14521. *Akada* (D).
14522. *Garathi.*
14523. *Nilwa Khandesh.*
14524. *Bile Juar.*
14525. *Kondal.*
14526. *Gari.*
14527. *Gudhagi.*
14528. *Dukri.*
14529. *Juari.*
14530. *Dakshni.*
14531. *Mergar* (B).
14532. *Kar Juar* (B).

14500 to 14775—Continued.

14533. *Akada.*
14534. *Mergari.*
14535. *Meldani.*
14536. *Fulgar* (A).
14537. *Nadial.*
14538. *Jowala.*
14539. *Akada* (E).
14540. *Adola.*
14541. *Bile Juar* (A).
14542. *Akada Khandesh.*
14543. *Garia* or *Dhavla.*
14544. *Kondi.*
14545. *Rati.*
14546. *Gid-Gidgempu.*
14547. *Fulgar Karajgi.*
14548. *Mumtnigal.*
14549. (Sampgaon variety No. 2)
14550. *Pandharpuri Ramker.*
14551. *Deola.*
14552. *Saphet.*
14553. *Lawhi.*
14554. *Haldi.*
14555. *Pivali Wani.*
14556. *Narli Wani.*
14557. *Ushira.*
14558. *Kalbondi.*
14559. *Edna.*
14560. *Dudhawani.*
14561. *Charoli Wani.*
14562. *Dukri* or *Talap.*
14563. *Daner.*
14564. *Bansmati.*
14565. *Lokhamdi.*
14566. *Deolari.*
14567. *Argar.*
14568. *Bagle* or *Supte.*
14569. *Ringna.*
14570. *Motichur.*
14571. *Badgonda.*
14572. *Baidria.*
14573. *Deola* (A).
14574. *Ganer.*
14575. *Mohwani.*
14576. *Bani.*
14577. *Pawana Nadi.*
14578. *Baidra* (A).
14579. *Lal Gunja.*
14580. *Palasi Juar.*
14581. *Motichur.*
14582. *Sholapuri.*
14583. *Nadyal.*
14584. *Juari.*
14585. *White Dumraon.*
14586. *Gumeri.*
14587. *Dukri.*
14588. *Durga.*
14589. *Bana of Jalaon.*
14590. *Bhanna of Jhansi.*
14591. *Lal.*
14592. *Jharloo.*
14593. *Doliya.*
14594. *Bania.*
14595. *Laliya.*
14596. *Supeta.*
14597. *Kombrai.*
14598. *Pyaria Iksari Banda.*
14599. *Iksari Banda.*
14600. *Pyaria.*
14601. *Safed Dupta Banda.*
14602. *Alapuri.*
14603. *Dulari.*
14604. *Dugadia Zard.*
14605. *Ikdani.*
14606. *Purbi Magha.*
14607. *Country White.*
14608. *Gugadia Safed.*
14609. *Jogia.*
14610. *Domni.*
14611. *Chatka.*
14612. *Bangra.*
14613. *Lallu.*
14614. *Bedaer.*
14615. *Gugadia.*
14616. *Gogla.*
14617. *Purbi Murabad.*
14618. *Deshi.*
14619. *Ganga Jamni.*

14500 to 14775—Continued.

14620. *Jamnapuri.*
14621. *Juar of Bijnore.*
14622. *Bannia Dadri.*
14623. *Pirbahi Lucknow.*
14624. *Pirbahi Unao.*
14625. *Dadri of Unao.*
14626. *Red of Ajangarh.*
14627. *Bannia.*
14628. *Jhalaria.*
14629. *Paundia.*
14630. *Dudhia.*
14631. *Jhangaria.*
14632. *Jhalria.*
14633. *Bannia of Sitapur.*
14634. *Palarhia.*
14635. *White of Ray Barelly.*
14636. *Natwa.*
14637. *Lagwa.*
14638. *Red.*
14639. *White.*
14640. *Mailki.*
14641. *Ganga Jali.*
14642. *Dudghiya.*
14643. *Nerio Perio.*
14644. *Bannia of Cawnpur.*
14645. *Nandiyal.*
14646. *Kabgar.*
14647. *Lohor.*
14648. *Yennigar.*
14649. *Mamadpuri Gidd.*
14650. *Vilayati* or *Kempugidd.*
14651. *Kalia Gondicha Vilayati.*
14652. *Mud Shedgar.*
14653. *Khabba Shedgar.*
14654. *Vibhuti Gund.*
14655. *Kala Gund.*
14656. *Moti Jondhala.*
14657. *Paramsali.*
14658. *Udda Maldani.*
14659. *Gidd Maldani.*
14660. *Bilegar.*
14661. *Gund.*
14662. *Bile Nandiyal.*
14663. *Amaldani.*
14664. *Baswanpad.*
14665. *Shedgar.*
14666. *Shalu.*
14667. *Makchandri.*
14668. *Holgi.*
14669. *Hundi.*
14670. *Zamli.*
14671. *Kagi Moti.*
14672. *Mangar.*
14673. *Kalbondi.*
14674. *Duhar Maski.*
14675. *Bendri.*
14676. *Guldhavi.*
14677. *Lakdi.*
14678. *Shalu.*
14679. *Nilwa.*
14680. *Gola.*
14681. *Nirwati.*
14682. *Gari.*
14683. *Ellichpuri.*
14684. *Khondi Chandor.*
14685. *Lakadia Juar.*
14686. *Dukri.*
14687. *Dadar.*
14688. *Khonde Malegaon.*
14689. *Shalu.*
14690. *Lagwa* (A).
14691. *Dagdi.*
14692. *Red* (erect-headed of No. 14638).
14693. *Juar Nandgaon.*
14694. *Shalu.*
14695. *Argad.*
14696. *Dukri.*
14697. *Hundi.*
14698. *Gidd-Gapp.*
14699. *Waradi Juar.*
14700. *Hundi.*
14701. *Jondhala.*
14702. *Maldani.*
14703. *Tambdi.*
14704. *Gudadi.*
14705. *Jagadi.*
14706. *Dadia.*

14500 to 14775—Continued.

14707. *Farfaria.*
14708. *Deshi Perio.*
14709. *Sholapuri.*
14710. *Chapti.*
14711. *Perio Halko.*
14712. *Nialo.*
14713. *Ratadia.*
14714. *Juar.*
14715. *Sundhia.*
14716. *Komasu Juar.*
14717. *Shalu Juar.*
14718. *Malvan.*
14719. *Utavli.*
14720. *Sakar Makar.*
14721. *Sundhia* (B).
14722. *Sorghum Amber.*
14723. *Sorghum Collier.*
14724. *Raj. Hansa.*
14725. *Imphee.*
14726. *Sakar Makar* (A).
14727. *Kend.*
14728. *Motichur.*
14729. *Perio.*
14730. *Sholapuri.*
14731. *Chapti.*
14732. *Nialo.*
14733. *Rati* (A).
14734. *Jogadi.*
14735. *Ellichpuri* (A).
14736. *Ellichpuri* (B).
14737. *Nilwa Poona* (not ordinary).
14738. *Kempu* (C).
14739. *Mevgar* (A).
14740. *Gidd Juari.*
14741. *Wani Perio.*
14742. *Kempu Poona.*
14743. *Kempu.*
14744. *Kempu* (A).
14745. *Kempu* (B).
14746. *Kachakachi.*
14747. *Gundi Teni.*
14748. *Kempu Malkin.*
14749. *Holgi Gola.*
14750. *Dudha Mogra.*
14751. *Tambdi Sholapuri.*
14752. *Dukri* (A).
14753. *Dukri* (B).
14754. *Sargad.*
14755. *Gund Chikodi.*
14756. *Gund Chikodi* (A).
14757. *Gund* (A).
14758. *Paramsali.*
14759. *Hassar Juar* (Sampgaon).
14760. *Hassar.*
14761. *Holgi Jola.*
14762. *Chikna.*
14763. *Maldani* (A) (Poona).
14764. *Kempu* (D).
14765. *Vairagad Belsi.*
14766. *Kagi.*
14767. *Darker.*
14768. *Darker* (A).
14769. *Sundhia Juwar* (Poona Farm).
14770. *Nilwa* (Bombay Presidency).
14771. *Utavli.*
14772. *Kavli.*
14773. *Charodi* (Surat Farm).
14774. *Ameria Sundhia* (Nadiad Farm).
14775 *Farfaria.*

14776. PANICUM MAXIMUM. **Guinea grass.**

From Sydney, New South Wales. Presented by Anderson & Co., George street. Received June 3, 1905.

14777. OPUNTIA FICUS-INDICA. **Prickly pear.**

From Honolulu, Hawaii. Presented by Mr. C. C. Conradt. Received June 3, 1905.

14778. JUNCUS EFFUSUS CONGLOMERATUS. **Matting rush.**

From Cat Island, S. C. Collected by Mr. J. H. Tull, June 1, 1905.

14779 to 14785. ORYZA SATIVA. **Rice.**

From Nagpur, India. Presented by Hon. J. W. Mollison, Inspector-General of Agriculture. Received June 5, 1905.

14779. *Badshah Bhog.*

"A fine-scented variety grown in Bengal Presidency. Grows best on clay or sandy loam, and requires ample water till the variety comes into ear." (*Mollison.*)

14780. *Welchi.*

"A coarse variety grown in Bombay Presidency. Requires black soil and ample water till ripening." (*Mollison.*)

14781. *Kamod.*

"A fine-scented variety grown in Bombay Presidency. Grows on black or light soil, and requires ample water till ripening." (*Mollison.*)

14782. *Basmati.*

(See remarks on No. 14779.)

14783. *Dad Khani.*

(See No. 14779, with the exception that this is not a scented variety.)

14784. *Ambe Mohr.*

"A fine-scented variety grown in Bombay Presidency. Requires black soil and ample water till ripening." (*Mollison.*)

14785. *Katri Bhog.*

(See remarks on No. 14783.)

14786. MEDICAGO SATIVA. **Alfalfa.**

From Tashkend, Turkestan. Received thru Mr. H. W. Dürrschmidt, June 3, 1905.

14787. OPUNTIA sp. **Prickly pear.**

From San Luis Potosi, Mexico. Received from Dr. Edward Palmer, thru Dr. J. N. Rose, of the United States National Museum, June 9, 1905.

Tuna Tapona de Castilla.

14788. FREESIA sp.

From Burnett, Cal. Received thru Rees & Compere, June 12, 1905.

14789. NERINE sp.

From Raleigh, N. C. Received thru Prof. W. F. Massey, Agricultural Experiment Station, June 12, 1905.

14790. HYACINTHUS ORIENTALIS. **Roman hyacinth.**

From Burnett, Cal. Received thru Rees & Compere, June 13, 1905.

Albulus. From S. P. I. No. 12233. Received from J. M. Thorburn & Co. in the autumn of 1904.

14791 to 14798. ZEA MAYS. **Corn.**

From Richmond, Va. Received thru T. W. Wood & Sons, June 13, 1905.

Recommended to be the best varieties of corn for feeding green to stock; to be tested on sandy land near Washington, D. C.

14791. *Cocke's Prolific.*

14792. *White Columbia.*

14793. *Hickory King.*

14794. *Mammoth Shoe Peg.*

14795. *Holt's Strawberry.*

14796. *Eureka.*

14797. *Virginia Ensilage.*

14798. *Blount's Prolific.*

14799. FREESIA sp.

From Great Neck, Long Island, N. Y. Received thru Mr. Rudolph Fischer, June 13, 1905.

Purity.

14800. SOLANUM TUBEROSUM. **Potato.**

From Elmira, N. Y. Received thru Prof. L. R. Jones from Mr. C. F. Vanderhoff, Oak Grove fruit farm, May 18, 1905.

Blightproof. "Recommended as remarkably resistant to disease (blight) and also excelling in yield, size, uniformity, and compactness of tuber development in the hills." (*Jones.*) (L. R. Jones's No. 64.)

14801. GOSSYPIUM sp. **Cotton.**

From Lima, Peru. Received thru W. R. Grace & Co., New York, N. Y., June 7, 1905.

Seed of Peruvian cotton grown at Ica, in the southern part of Peru.

14802 to 14805.

From Pfiffelbach, near Apolda, Germany. Received thru Mr. A. Kirsche, June 8, 1905.

14802. AVENA SATIVA. **Oat.**

14803. TRITICUM VULGARE. **Wheat.**

Spring.

14804. BETA VULGARIS. **Beet.**

Ideal.

14805. DAUCUS CAROTA. **Carrot.**

14806 to 14810. OPUNTIA FICUS INDICA. **Prickly pear.**

From Malta. Received thru Dr. G. Borg, of San Giovanni, June 12, 1905.

14806. Small, yellow-fruited, seedless.

14807. White-fruited.

14808. Red-fruited.

14809. Reddish yellow fruited, seedless.

14810. Yellow-fruited.

14811. POLIANTHES TUBEROSA. **Tuberose.**

From Austin, Tex. Presented by Mr. F. T. Ramsey. Received June 16, 1905.

14812. LILIUM PHILIPPINENSE. **Benguet lily.**

From Boston, Mass. Received thru R. & J. Farquhar & Co., June 16, 1905.

14813 and 14814.

From Manila, P. I. Received thru Prof. William S. Lyon, horticulturist in charge of seed and plant introduction, Bureau of Agriculture, Manila, P. I., June 6, 1905.

14813. ERIODENDRON ANFRACTUOSUM.

"The lint with us is a better color than some of the kapok that comes from Java, and commands a better price in this market. It is, I think, perhaps due more to climatic or soil influences than to any varietal difference." (*Lyon.*)

14814. ORANIA PHILIPPINENSIS.

"Pericarp rich in starch—24 per cent. Very ornamental." (*Lyon.*)

14815. NEPHELIUM MUTABILE. **Kapoelasan.**

From Buitenzorg, Java. Presented by Doctor Treub, director of the Department of Agriculture. Received June 19, 1905.

14816 to 14821. OPUNTIA FICUS INDICA. **Prickly pear.**

From Palermo, Sicily. Received thru Dr. A. Borzi, director of the Botanic Gardens, June 10, 1905.

14816. *Zuccarina.*
14817. *Frutti Sanguinei.*
14818. *Senza Chiupi.*
14819. *Rossi.*
14820. *Bianchi.*
14821. (Miscellaneous; unlabeled.)

14822 to 14839. OPUNTIA spp. **Tuna.**

From San Luis Potosi, Mexico. Received from Dr. Edward Palmer, thru Doctor Rose, of the National Museum, June 19, 1905.

14822. *Blanca Crystalina.* (Doctor Rose's No. 580/05.)
14823. *Redonda Colorado.* (581/05.)
14824. *Pachona.* (582/05.)
14825. *Cueja.* (583/05.)
14826. *Joconostle.* (595/05.)
14827. *Durasnillo Blanco.* (597/05.)
14828. *Narancada.*
14829. *Cueja Arantidea.* (600/05.)
14830. *Mansa Colorado.* (600/05.)
14831. *Cacalota Blanca.* (604/05.)
14832. *Camuesa* or *Camessa.* (606/05.)
14833. *Tuna Blanca.* (607/05.)
14834. *Xoconochtli Agre.* (608/05.)
14835. *Joconostle Cambria.* (609/05.)
14836. *Cameosa Color de Rose.* (610/05.)
14837. *Amerea Mansa.* (612/05.)
14838. *San Miguel Lania.* (617/05.)
14839. *Nopalea.* (661/05.)

"An opuntia found in the dense wood to the height of 20 or more feet. Where found alone exposed it has a neat, rather compact top, with a naked stem of 7 to 9 feet and from 6 to 8 inches in diameter, with bunches of thorns up the stem. The fruits are small." (*Palmer.*)

14840 to 14869.

From Frescati, near Stockholm, Sweden. Presented by Prof. Veit Wittrock, June 21, 1905.

A collection of grass and forage crop seeds:

14840. AGROSTIS ASPERULA.
14841. AVENA PLANICULMIS.
14842. BROMUS ANDINUS.
14843. DACTYLIS ASCHERSONIANA.
14844. ELYMUS CHUBUTENSIS.
14845. ELYMUS SABULOSUS.
14846. PHLEUM MICHELII.
14847. POA ATTICA.
14848. TRITICUM CRISTATUM.
14849. TRITICUM DASYANTHUM.
14850. TRITICUM DESERTORUM.
14851. TRITICUM INTERMEDIUM.
14852. TRITICUM VIOLACEUM.
14853. MEDICAGO CARSTIENSIS.
14854. MELILOTUS ELEGANS.
14855. MELILOTUS SULCATA.
14856. MELILOTUS TOMMASINI.
14857. TRIFOLIUM ALPESTRE.
14858. TRIFOLIUM BADIUM.
14859. TRIFOLIUM MONTANUM.

14840 to 14869—Continued.

14860. Trifolium ochroleucum.

14861. Trifolium rubens.

14862. Vicia altissima.

14863. Vicia calcarata.

14864. Vicia dasycarpa.

14865. Vicia disperma.

14866. Vicia dumetorum.

14867. Vicia grandiflora kitaibeliana.

14868. Vicia pisiformis.

14869. Vicia sepium.

14870. Gossypium sp. **Cotton.**

From Cartavio, Peru. Presented by Mr. T. F. Sedgwick, of the Cartavio Sugar Company. Received June 14, 1905.

14871 to 14878. Nicotiana tabacum. **Tobacco.**

From Sao Paulo, Brazil. Presented by Dr. H. M. Lane, Mackenzie College. Received June 20, 1905.

Brazilian tobacco seed:

14871. *Georgiana.* From Descalvado, State of Sao Paulo.

14872. From Pirassununga, State of Sao Paulo. Not named, but highly esteemed in the locality.

14873. *Bussucaba.* From near the city of Sao Paulo, State of Sao Paulo.

14874. *Crioula.* From Santa Rita, State of Sao Paulo.

14875. *Fumo Bahia.*

14876. *George Grande.* From the State of Rio de Janeiro.

14877. *Goyana.* Yellow, from the State of Goyaz.

14878. *Goyana.* White, from the State of Goyaz. Doctor Lane says that both the yellow and the white *Goyana* are famous thruout the country.

14879. Zephyranthes sp.

From San Luis Potosi, Mexico. Presented by Dr. Edward Palmer, thru Dr. J. N. Rose. Received June 19, 1905.

14880 and 14881. Vicia faba. **Horse bean.**

From Paris, France. Received thru Vilmorin-Andrieux & Co., June 22, 1905.

14880. *Printemps de Lorraine, petite.*

14881. *D'Hiver.*

14882. Zizyphus sp. (?).

From Bulsar, India. Presented by Rev. W. R. Miller, 466 Jackson boulevard, Chicago, Ill. Received June 23, 1905.

14883. Medicago sativa. **Alfalfa.**

From Logan, Mont. Received thru Mr. William Carpenter, June 24, 1905.

14884. Cinnamomum camphora. **Camphor.**

From Yokohama, Japan. Received thru L. Boehmer & Co., June 24, 1905.

14885 to 14887. Gossypium spp. **Cotton.**

From Sydney, New South Wales, Australia. Received thru Mr. J. H. Maiden, director of the Botanic Garden, July 7, 1905.

Cotton seed and samples of lint secured on request from Mr. David Thomatis, Caravonica, Cairns, North Queensland, Australia, April 21, 1905.

14885. *Caravonica I.* (Wool cotton.)

14886. *Peruvian Kidney.*

14887. *Caravonica II.* (Silk cotton.)

14888. Nephelium litchi. **Litchi.**

From Honolulu, Hawaii. Received from Mr. G. P. Wilder, thru Mr. James Mills, Arlington Heights Fruit Company, Riverside, Cal., July 10, 1905.

"The tree which bore these fruits is one of the two or three mature trees of this species in Hawaii and is the property of Mrs. Afong. The price of these fruits is about 3 cents each on the retail market of Honolulu. Seeds from Mrs. Afong's trees are being extensively planted in the islands; the demand is likely to be much greater than the supply for many years. It is believed the variety comes fairly true from seed, but in China, where about six distinct sorts are recognized, grafting or inarching is relied upon for best results.

"The yellowish, sweet, pulpy arillus of this fruit is highly esteemed in China, Cochin China, and the Philippines. It also fruits in East Australia, and it can undoubtedly be grown with profit in Porto Rico, south Florida, and California.

"The fruit resembles a strawberry or large acorn in size and shape but has a shell-like, rough skin; the pulp is white, very juicy, and of a peculiar sweet and sour flavor, the taste for which does not have to be acquired." (*Wilder.*)

14889 and 14890. Persea gratissima. **Avocado.**

From City of Mexico, Mexico. Presented by the American ambassador. Received July 13, 1905.

14889. *Seedless.* **14890.** *Seedless Butter.*

14891. Solanum muricatum (?). **Pepino.**

From Port of Spain, Trinidad. Received thru Mr. Eugene André, July 7, 1905.

14892. (Undetermined.)

From Kongo Free State, Africa. Presented by the director of the Botanical Garden at Eala, thru the Department of Finances, Brussels, Belgium. Received July 17, 1905.

A wild ornamental recently discovered in the Kwango Oriental district of the Lower Kongo, Kongo Free State.

14893 and 14895. Solanum tuberosum. **Potato.**

From Quito, Ecuador. Presented by Mr. L. Martines, chief of the Department of Public Instruction, Section of Agriculture.

Seed potatoes.

14893. *Chola.*

From the "El Obraje" estate, Señor Luis F. López Ortega, proprietor, parish of Chillogallo, Province of Pichincha, 2,900 meters above sea level. (No. 1.)

14894. *Uchu-rumi.*

From the "Carrión" estate, Señor Carlos Mateus, proprietor, parish of Lloa, Province of Pichincha, 2,900 meters above sea level. Grown in alluvial soil. (No. 2.)

14895. *Chola.*

Grown on same estate as preceding, at the base of Pichincha volcano, 2,900 meters above sea level, in dark, heavy soil. (No. 3.)

14896 to 14906.

From Richmond, New South Wales. Presented by Mr. H. W. Potts, principal of the Hawkesbury Agricultural College. Received June 26, 1905.

14896. Andropogon affinis.
14897. Eragrostis brownii interrupta.
14898. Eragrostis leptostachya.
14899. Eragrostis pilosa.
14900. Sterculia diversifolia.
14901. Ehrharta stipoides.
14902. Panicum effusum.
14903. Panicum sanguinale.
14904. Paspalum brevifolium.
14905. Chaetochloa glauca.
14906. Stipa tuckeri.

14907. CITRUS DECUMANA. **Pomelo.**

From Oneco, Fla. Received thru Reasoner Brothers, July 3, 1905.

Stick's Tresca Red.

14908. PHYSALIS EDULIS. **Cape gooseberry.**

From Cape Town, South Africa. Presented by Prof. C. P. Lounsbury, government entomologist, Cape of Good Hope Department of Agriculture. Received June 26, 1905.

"The mother plantation is at Wynberg, here in the Cape Peninsula. The plant with us is a perennial, but the frost will cut it down. In some districts it fruits well; in others, scarcely at all. It seems to do best on the border of woodlands. A species of Tetranychus is its one great pest in South Africa. Mr. Malley tells me that his brother has tried it in Texas without success." (*Lounsbury.*)

14909 to 14921. ZEA MAYS. **Popcorn.**

From Santiago, Chile. Presented by Señor Salvador Izquierdo, Santa Ines, near Santiago. Received June 23, 1905.

"Samples of popcorn used in Chile for the manufacture of 'llalli.' Samples were without names or specific data other than the above." (*Fairchild.*)

14922. THYSANOLAENA AGROSTIS.

From Calcutta, India. Presented by A. Gage, officiating superintendent, Royal Botanic Garden, Sibpur, near Calcutta. Received June 24, 1905.

See S. P. I. No. 8445, for a description of this unusually beautiful ornamental cane.

14923 to 14944. OPUNTIA sp. **Tuna.**

From San Luis Potosi, Mexico. Received from Dr. Edward Palmer thru Dr. J. N. Rose, of the United States National Museum, June, 1905.

14923. *Pachona.*
14924. *Pasteada Lisa.*
14925. *Narancow Lisa* (spineless.)
14926. *San Juanara Manzana*, blanca.
14927. *Cameosa Lisa.*
14928. *Tuna Blanca Seca.*
14929. (No label.)
14930. *Morada.*
14931. (Spineless.)
14932. (No label.)
14933. (No label.)
14934. (No label.)
14935. (No label.)
14936. (No label.)
14937. (Doctor Rose's No. 613/05.)
14938. (Doctor Rose's No. 614/05.)
14939. *Ranchera* (Doctor Rose's No. 643/05).
14940. *Cueja* (Doctor Rose's No. 644/05).
14941. (Doctor Rose's No. 646/05.)
14942. *Camuesa Prisco* (Doctor Rose's No. 673/05).
14943. *Mansa Color de Rosa* (Doctor Rose's No. 674/05).
14944. *Crystalina Blanca* (Doctor Rose's No. 675/05).

14945 and 14946. GOSSYPIUM sp. **Cotton.**

From Payta, Peru. Received thru Duncan, Fox & Co., July 3, 1905.

14945. Brown seed.
14946. White seed.

14947. CUCURBITA MELANOSPERMA.

From San Luis Potosi, Mexico. Presented by Dr. Edward Palmer. Received June 22, 1905.

"One fruit called '*Cila callote*' from a vine that is very productive. The fruit keeps several months. Fine preserves are made from it—one from the interior after the seeds are removed, another in the ordinary way, the third a hard marmalade. If the seeds are sent to some suitable experiment station with long seasons, they will be as useful as in Mexico." (*Palmer.*)

14948. LAPAGERIA ROSEA. **Chilean bellflower.**

From Coronel, Chile. Presented by Mr. Teodoro Finger, of La Compania de Aranco (Limited). Received July 3, 1905.

"The plant is a creeper, evergreen and lasting, growing up the highest trees and covering the same entirely with its foliage, and in winter the most beautiful scarlet-red big bell-like blossoms make it the favorite Chilean flower for the sight and decoration when no other flowers are blooming. It has given to the Chilean forests a peculiarly attractive and beautiful appearance, being mentioned by almost every traveler. It grows on any soil, preferring heavy red-clay soil. It requires fair watering. It always climbs up a bushy shrub or on a tree. You can sow it in spring, and it stands a light frost without danger. It is entirely an ornamental plant. The roots go down very deep and form a potato at the end, which causes the death of the plant if it is cut off at transplanting. The plants have been taken to Europe, and especially are they grown in hothouses and winter gardens in England. It has caused attention that the plants transplanted to Europe, giving once red blossoms, will never give red blossoms again, but only white ones. It is very difficult to get ripe seeds in the virgin forests, as the birds are very fond of them. The seeds are covered with a small cucumber-like and a little sourish-tasting mass, which the natives like to eat. I find no pleasant taste in them at all." (*Finger.*)

14949 to 14951. OPUNTIA spp. **Tuna.**

From San Luis Potosi, Mexico. Received from Dr. Edward Palmer, thru Mr. W. E. Safford, of the Bureau of Plant Industry, June, 1905.

14949. *Tapona.* Red, globular fruit.

14950. *Cardona.* Yellow fruit.

14951. (An unnamed variety; has thick, tuberculated root.)

14952 to 14962.

From Shanghai, China. Presented by Mr. Edward S. Little. Received in May, 1905.

14952. GLYCINE HISPIDA. **Soy bean.**

Black.

14953. GLYCINE HISPIDA. **Soy bean.**

Large yellow.

14954. GLYCINE HISPIDA. **Soy bean.**

Small yellow.

14955. PANICUM MILIACEUM. **Broom-corn millet.**

Red.

14956. PANICUM MILIACEUM. **Broom-corn millet.**

White.

14957. BRASSICA CHINENSIS. **Chinese rape.**

14958. SESAMUM INDICUM. **Sesame.**

Black.

14959. SESAMUM INDICUM. **Sesame.**

White.

14960. PHASEOLUS RADIATUS. **Mung bean.**

14961. ARACHIS HYPOGAEA. **Peanut.**

Small.

14962. ARACHIS HYPOGAEA. **Peanut.**

Large.

14963. ORYZA SATIVA. **Rice.**

From Kobe, Japan. Presented by Mr. K. Ojuni, custom-house, Kobe, Japan. Received April 17, 1905.

14964 to 14971.

From Kashmir, India. Received thru the Office of Farm Management Investigations, July 8, 1905. Seeds collected by Messrs. Ellsworth Huntington and R. L. Barrett.

14964. HORDEUM VULGARE. **Barley.**

"Barley from Sonamarg, in the Sind Valley, Kashmir. Altitude, 8,500 feet; rainfall, probably 50 inches." (*Huntington.*)

14965. HORDEUM VULGARE. **Barley.**

Hull-less. "From Dras, in the Indus Valley, India. Altitude, 10,100 feet; rainfall, probably about 30 inches, mostly as snow. Irrigation is practised. Snow was 6 feet deep April 13, and lasts till well into May." (*Huntington.*)

14966. LATHYRUS sp.

From Dras, in the Indus Valley, India.

14967. ORYZA SATIVA. **Rice.**

"From Kund, in the Sind Valley, Kashmir, India. Elevation, 6,800 feet. The climate of this region is so severe that on April 7, 1905, after an unusually hard winter, the ground was still well covered with snow. The rainfall of the region is perhaps 40 to 50 inches, well distributed thruout the year." (*Huntington.*)

14968. PANICUM MILIACEUM. **Broom-corn millet.**

"From Kulan in the Sind Valley, Kashmir, India. Altitude, 7,200 feet. Precipitation, about 40 inches. Snow lasts till April." (*Huntington.*)

14969. FAGOPYRUM TATARICUM. **Buckwheat.**

"Hindustani '*trumba*,' from Kund, in the Sind Valley, Kashmir, India. Altitude, 6,800 feet. The climate of this region is such that on April 7, 1905, after an unusually severe winter, the ground was still well covered with snow. This grain is said to make good bread, tho slightly bitter. The rainfall of the region is perhaps 40 inches or more, well distributed thruout the year." (*Huntington.*)

14970. TRITICUM VULGARE. **Wheat.**

"From Tashgam, Indus Valley, India. Rainfall from 25 to 30 inches, mostly as snow. Irrigation necessary. Snow lasts till middle of April." (*Huntington.*)

14971. ZEA MAYS. **Corn.**

"From Kund, in the Sind Valley, Kashmir, India. Altitude, 6,800 feet. The rainfall of the region is perhaps 40 to 50 inches, well distributed thruout the year. The climate of this region is such that on April 7, 1905, after an unusually severe winter, the ground was still covered with snow." (*Huntington.*)

14972 and 14973.

From Quito, Ecuador. Presented by L. Martines, chief of the Department of Public Instruction, Section of Agriculture. Received July 13, 1905.

14972. MEDICAGO SATIVA. **Alfalfa.**

From Guanando district, Province of Chimborazo, 2,400 meters above sea level.

14973. SOLANUM TUBEROSUM. **Potato.**

Chauca. White and black. Early variety from Hacienda Magdalena, Province of Imbabura, 2,225 meters above sea level.

14974 and 14975.

From Sao Paulo, Brazil. Presented by Dr. H. M. Lane, July 25, 1905.

14974. PHASEOLUS LUNATUS. **Lima bea**

Grown in Batataes. Doctor Lane says that these are the most wonderful prolific pole beans he ever saw.

14975. NICOTIANA TABACUM. **Tobacc**

Seed from Goyaz. Doctor Lane is afraid it is a mixt lot, as the friend wl sent it wrote: "It contains the best varieties grown in the State. The *Whi* *Yellow*, and *Giant* can easily be distinguished in the plants."

14976 to 14979. NICOTIANA TABACUM. **Tobacc**

From Cachoeira, Bahia, Brazil. Received from Mr. W. A. Waddell, July 2 1905. Sent at the request of Dr. H. M. Lane, of Sao Paulo.

14976. Seed from Santa Estevao.

14977. Seed from Outeiro Redendo.

14978. Seed from Cabeças Murityba.

14979. Seed from Cruz d Almas.

14980 to 14983. OPUNTIA spp. **Prickly pea**

From Tunis, North Africa. Received thru the director of the Tunisian Depar ment of Agriculture and Commerce, July 28, 1905.

14980. OPUNTIA FICUS-INDICA.

14981. OPUNTIA TUNA.

14982. OPUNTIA FICUS-INDIC INERMIS.

14983. OPUNTIA ROBUSTA.

14984 to 14989.

From Cape Town, South Africa. Received thru the Smithsonian Institutio from Mr. H. J. Chalvin, superintendent of the Municipal Gardens, July 29, 190

14984. ASPARAGUS CRISPUS.

14985. FREESIA REFRACTA ALBA.

14986. SPARAXIS BULBIFERA.

14987. SPARAXIS PURPUREA.

14988. SYNNOTIA BICOLOR.

14989. TRITONIA FENESTRATA.

14990 and 14991.

From Paris, France. Received thru Vilmorin-Andrieux & Co., August 10, 190

14990. VICIA VILLOSA. **Hairy vetc**

14991. HEDYSARUM CORONARIUM. **Sulla**

14992. ZEA MAYS. **Popcorn**

From Amboina, Dutch East Indies. Presented by Mr. Roskott. Receive August 9, 1905.

14993. CITRUS AUSTRALASICA. **Finger lime**

From Queensland, Australia. Presented to Prof. W. M. Hays, St. Anthony Park Minn., by Mr. James Pink, of Wellington Point, near Brisbane. Receive August 11, 1905,

"It is a fruit which I think capable of great improvement. Nothing has eve been attempted with it here, and I send you a few dried fruits which, I have no doubt, contain good seeds. The plant is a large shrub, very limited in its distribution.

"The fruit when well grown is from 3 to 4 inches long, of a bright orange-crimson color, and of excellent flavor." (*Pink.*)

14994. TRIFOLIUM INCARNATUM. **Crimson clover.**

From New York, N. Y. Received thru Henry Nungesser & Co., August 11, 1905.

995. DAHLIA IMPERIALIS. **Dahlia.**

From Queenstown, Cape Colony. Received thru Mr. F. Beswick, secretary of the Queenstown Public Gardens, August 14, 1905.

996 to 14998.

From Mexico. Received thru Dr. J. N. Rose, of the United States National Museum, August 14, 1905.

14996. SCHOENOCAULON sp.

14997. JUGLANS sp.

14998. PINGUICULA sp.

999. EUPATORIUM PORTORICENSE. **"Guerrero."**

From Mayaguez, P. R. Received thru Mr. O. W. Barrett, from the Agricultural Experiment Station, August 15, 1905.

"A shrub, 1 to 3 meters high, found in a semicultivated state in the western part Porto Rico. The dried leaves have a strong vanilla-like fragrance and are used in enting the better grades of Porto Rican tobacco. Tho a perennial, this plant will obably fruit in the latitude of Connecticut; it is a very rapid grower." (*Barrett.*)

000 to 15210. PHOENIX DACTYLIFERA. **Date.**

From Tunis, North Africa. Received thru Mr. Thomas H. Kearney, agricultural explorer, who secured them during his explorations in the winter of 1904–5 in the oases of southern Tunis.

"The nomenclature is that secured by Mr. Kearney from the Arabs from whom he ught the suckers, and the descriptions were made partly in Tunis and partly after s return to this country. See his bulletin on the date palms of Tunis." (*Fair-ild.*)

15000. *Ammary.*

A third-class "soft" variety; fruit 1¼ to a little over 1½ inches long, about one-half as wide, generally obovoid, square at the base, rounded at the apex, keeping its shape fairly well when preserved, dark-brown purple when ripe; the flesh 1½ lines thick, very soft and dark colored; the seed about two-thirds as long as the fruit, about two-fifths as wide as long, blunt at both ends. The stalks and branches of the fruit clusters are orange colored.

The earliest maturing variety in Tunis, ripening in August and September. Said to give a very good crop every year and to be very productive.

15001. *Angoo.*

A second-class "dry" variety; fruit barely 1 inch long, about seven-tenths as wide, sometimes broadest below, sometimes above the middle; bright bay-colored when ripe, much of the skin becoming loosened in large blisters, the flesh a little over 1 line thick, becoming firm and dry, the white central portion thicker than the dark-colored outer zone; the seed about two-thirds as long as the fruit, about one-half as wide as long, light-drab brown. The stalks of the fruit clusters are lemon yellow.

The smallest fruited of the Tunisian varieties. Despite its diminutive size and thin flesh, this little date is one of the most attractive of the "dry" type. Because of its moderately sweet, wholesome, nutty flavor it can be eaten in large quantities without cloying, and should be a healthful food. Ripens in midseason.

15002. *Areshty.*

A first-class "soft" variety; fruit 1⅔ to 2½ inches long, one-half to two-thirds as wide, slightly larger above than below the middle, broad and rounded at the apex, light bay or hazel brown when ripe; the flesh 2½ to 3 lines thick, firm but tender; the seed about one-half as long as the fruit, rather thick, irregularly roughened. The stalks and branches of the fruit clusters are light orange. The foliage of this variety is rather light and the leaves drooping.

One of the largest dates grown in Tunis. The fruit is generally egg-shaped, ripening about the middle of October. The flavor of the thoroly ripe fruit is agreeable, altho not very remarkable, wholesome, nut-like, and not easily cloying. The flesh becomes quite firm and the ripe fruit keeps its shape well when preserved.

15000 to 15210—Continued.

15003. *Baydh Hammam.*

A second-class "soft" variety; fruit 1⅜ to 1¾ inches long, three-eighths to five-eighths as wide, egg-shaped, broadest near the middle, rather conspicuously blunt-pointed at apex, not keeping its shape well, dark chestnut brown with a tinge of maroon when ripe; the flesh very soft and dark colored, about 2 lines thick; the seed one-half to five-eighths as long as the fruit, one-third to two-fifths as wide as long; dark brown. The stalks and branches of the fruit clusters are orange colored. The foliage is of a rather delicate aspect and the leaves numerous.

This is a handsome, dark-brown date with very soft, dark-colored flesh. It is always eaten fresh, not being conservable. It is exceedingly sweet. The flavor of the perfectly ripe fruit is agreeable and very characteristic. It ripens rather late, hardly before November.

15004. *Bayjoo*, or *Badjou.*

A third-class "dry" date; fruit 1⅓ inches long, about two-thirds as wide, ovoid, purplish maroon or bay colored when ripe; the flesh 1½ lines thick; the seed nearly two-thirds as long as the fruit, one-half as wide as long; light brown. The stalks and branches of the fruit clusters are pale orange colored. The small, dense bunches of fruit hang down on long curved stalks.

Flavor nutty, agreeable but not very characteristic, typical of the "dry" date class. Matures in October.

15005. *Bent Segny.*

A third-class "soft" variety; fruit 1¾ to 1⅞ inches long, about one-half as wide, obovoid, square at base, rounded at apex, keeping its shape poorly when preserved, very dark purplish brown (almost black) when ripe; the flesh 1½ lines thick, very dark colored and very soft; the seed about one-half as long as the fruit, two-fifths to one-half as wide as long, rounded at both ends. The stalks and branches of the fruit clusters are deep orange colored.

A very soft, sirupy date, with a pleasant but not remarkable flavor. Ripens about the end of October.

15006. *Besser Haloo*, or *Bisra Haloua.*

A second-class "soft" variety; fruit 1⅓ to 1½ inches long, about two-thirds as wide, broadest at or above the middle, rounded at the apex, keeping its shape well when ripe, bright bay colored; the flesh 2 lines thick, comparatively dry when the fruit is ripe, light brown; the seed two-thirds to three-fourths as long as the fruit, generally two-fifths as wide as long, with more or less conspicuous winglike ridges on the sides. The spreading or ascending stalks of the fruit clusters are so short that the small bunches are nearly hidden by the foliage. The leaves are short and rather stiff, with comparatively short stalks and wide leaflets.

A small, light-colored date, with thick, comparatively firm flesh. It is very sweet and has an agreeable flavor, somewhat intermediate between that of Lagoo and that of Horra. The natives seem to prefer it when not perfectly ripe. It matures early in October. One of the six most productive varieties. Among the four most salt-resistant varieties.

15007. *Boo Affar.*

A first-class "soft" date; fruit about 2 inches long and five-ninths to three-fifths as wide, conspicuously wider above than below the middle, but narrowed to the blunt apex, bright purplish maroon when ripe; the flesh 3 to 3½ lines thick, tender yet firm; the seeds a little more than one-half as long as the fruit, cinnamon brown. The stalks and branches of the fruit clusters are deep orange. The foliage is said to be heavy and the leaves wide and very green.

The fruit is remarkable not only for its large size, thick flesh, and delicious flavor, but for its beautiful coloring; ripens rather late. The flesh is tender, yet rather firm, and is very sweet and full of sugar. The skin, even of the ripe fruit, is fairly clean and dry.

15008. *Boo Fagoos;* also spelled *Bou Fagous*, or *Feggouss.*

A first-class date of the "soft" type; fruit 1⅔ to 1⅞ inches long, considerably more than one-half as wide, constricted near the middle and widest toward the apex, maroon to prune purple when ripe; the flesh 2½ lines thick; the seed

15000 to 15210—Continued.

five-ninths to five-eighths as long as the fruit, rather slender. The orange-colored stalks of the fruit clusters are sharply curved, and so short that the rather small bunches hardly extend beyond the leafstalks.

The foliage of this, as of several other of the finest varieties, is of a light and delicate aspect, due in this case to the relatively few leaves and the narrowness of the leaflets. The leaves themselves are large and wide, curving downward very noticeably.

The large fruit is remarkable for its unusual shape, somewhat like that of a fiddle or of some of the varieties of gherkins, to which it doubtless owes its Arabic name. The flesh is thick and rather firm, yet tender. It is very sweet and has a very distinctive and highly attractive flavor. It ripens late in October.

15009. *Deglet Barca.*

Fruit said to be "soft," round, and nearly black. It is described as a soft date that preserves very well.

15010. *Deglet Caid.*

Fruit coral red before maturity, and black when ripe; said to be conservable only for a short time. Reported to be a fine variety and to ripen early in September.

15011 and 15012. *Deglét Noor.*

A first-class "soft" date; fruit 1⅓ to a little over 2 inches long and about one-half as wide, ovoid oblong in shape, generally widest at or near the middle and blunt pointed at the apex, often narrowed also at the base, maroon colored when ripe; the flesh 2 to 3 lines thick, translucent; the seed about five-ninths as long as the fruit, conspicuously pointed, and dark chestnut brown in color. The stalks and branches of the fruit clusters are bright yellow (not orange), with stalks long and slender, sharply curved near the base, so that the bunches hang down far below the crown of foliage.

The Deglet Noor presents a combination of characteristics—fine flavor, sweetness, attractive appearance, cleanliness, good keeping qualities—that can be rivaled by no other variety that is widely grown. It requires a high sum total of temperature to bring it to perfect maturity; begins to ripen in quantity toward the end of October, slower in coming into full bearing than most varieties, the palms generally not giving a good crop until they are 10 years old, producing largely only every second or third year.

15013. *Deglet Sennaga.*

A "soft" date; fruit 37.5 to 40 mm. long, 17.5 mm. wide, oblong, somewhat pointed at the apex, bright chestnut brown when ripe, surface shining, skin much loosened and folded; flesh soft, dark colored; seed large, dark brown; very sweet; flavor distinctive (suggesting burnt sugar) and rather agreeable, but not very pronounced. It is said to keep well.

15014. *Dokar.* (Early, male.)

15015. *Dokar.* (Medium, male.)

15016. *Dokar.* (Late, male.)

15017. *Doonga*, or *Denanga.*

A second-class "soft" date; fruit a little over 1½ inches long, six-tenths to seven-tenths as wide, egg-shaped, broadest near the base, dull dark purplish maroon when ripe; the flesh 1½ to 2 lines thick, firm white, central portion nearly as thick as the dark outer zone; seeds small and thick (only about one-half as long as the fruit and about one-half as wide as long), narrowed at both ends. The stalks and branches of the fruit clusters are light orange.

A dark-colored, rather small date, with moderately soft, dark-colored flesh and with a clean, dry skin. It is very sweet and of a fine flavor, suggesting that of Deglet Noor.

15018. *Fteemy*, or *Ftimi.*

A first-class "soft" date; fruit 1⅔ to 2 inches long, about one-half as wide, oblong, slightly narrowed at both ends, dark purplish maroon when ripe, the surface shining, the flesh soft and sirupy, about 2 lines thick, the seed about

15000 to 15210—Continued.

five-ninths as long as the fruit, slender. The foliage is luxuriant, and the numerous leaves are long, wide, and crowded with long, broad leaflets. In color they are decidedly bluish, owing to the presence of a heavy, white bloom.

Altho inferior in flavor to the Deglet Noor this is unquestionably an excellent variety, greatly excelling the Deglet Noor in vigor, rapid growth, early productiveness, and large yields. The oblong fruit, when ripe, is of fine reddish purple color, very rich in flavor, extremely sweet, and so soft and sirupy as to melt in the mouth when fresh. It can not be eaten in great quantity, however, without cloying. It becomes very sticky and is therefore less satisfactory as a dessert fruit than the Deglet Noor. This variety is considered one of the most productive, giving a good crop every year. Is a late ripening variety, its fruit beginning to mature in quantity at the same time as the Deglet Noor, about November 1. It ranks among the four most alkali-resistant varieties.

15019. *Gasby.*

A third-class "soft" variety; fruit 1⅞ to a little over 2 inches long, about two-fifths as wide, oblong, often conspicuously curved, very dark prune purple, with a conspicuous bloom when ripe, the surface dull, the skin rather tough, russet brown where loosened from the flesh; the flesh 1 line thick, dark colored, remaining rather soft; the slender seed five-ninths to three-fifths as long as the fruit, two-sevenths to one-third as wide as long, russet brown, often curved. The stalks and branches of the fruit clusters are deep orange colored.

Ripens very early. A handsome, long, dark-colored, generally curved date. Flavor is of the Lagoo type, rather attractive, suggesting that of raisins. It is said to keep very well.

15020. *Gasb Haloo.*

Fruit said to resemble Kenteeshy in color; described as sweeter and better flavored than Gasby.

15021. *Guern-el-Rhezal.*

Said to be a long, slender, curved date, with a stone unusually large and a thin flesh.

15022. *Goondy.*

A third-class "soft" variety; fruit about 1⅔ inches long, about one-half as wide, obovoid-oblong, keeping its shape fairly well when preserved, bay to maroon colored when ripe; the flesh about 1½ lines thick, dark colored, remaining rather soft, the seed five-eighths as long as the fruit, about one-third as wide as long. The stalks and branches of the fruit clusters are bright orange colored. Said to ripen as early as September 15.

Sweet and agreeable, but not of pronounced flavor; of the Lagoo type.

15023. *Holooa Bayda;* also *Halouaia.*

A second-class "dry" date; fruit 1⅓ to 1½ inches long, about one-half as wide, elliptical in outline, not conspicuously narrowed at the apex, widest near the middle, dull purplish bay w[illegible] ripe; the flesh 1 to 1½ lines thick, becoming very firm and dry; the seed about seven-tenths as long as the fruit and one-third to two-fifths as wide as long. The branches of the fruit clusters are pale orange.

Much like the Lemsy, but the fruit is even smaller. It ripens rather early and is generally eaten fresh, becoming hard and dry when preserved.

15024. *Halouaia.*

15025. *Hamra,* or *Hamraia.*

A third-class "dry" date; fruit 1¼ to 2 inches long, about one-half as wide, ovoid, tapering from near the base to the rounded apex, bright purplish maroon when ripe; the flesh 1 to 3 lines thick, becoming quite firm, the dark-colored outer zone thicker than the white central portion; the seed two-thirds to four-fifths as long as the fruit, generally about two-fifths as wide as long, sometimes with strongly developed winglike ridges on the sides. The stalks and branches of the fruit clusters are orange colored.

One of the largest and most showy of the "dry" dates. Much resembles Horra

15000 to 15210—Continued.

and surpasses it in brightness of color, but is decidedly inferior to it in flavor. Ripens in the latter part of October and the beginning of November. Said to keep well.

15026. *Horra.*

The name is also spelled "Hourra," "Harra," and "Herra."

A first-class "dry" date; fruit about 2 inches long, about one-half as wide, ovate, narrowed from the base to the rounded apex, rather dull purplish maroon when ripe, the flesh 2 to 2½ lines thick, with its white central zone much thicker than the dark outer portion, the seed usually about one-half as long as the fruit. The stalks and branches of the fruit clusters are orange yellow. The leaves are large, with very numerous slender leaflets.

The fruit is the largest and finest produced by any variety of the "dry" class. The flesh becomes quite solid in the ripe fruit, but is never extremely hard and dry. It has the characteristic nutty flavor of the dry dates, but is much richer than most of them. It is at its best only when perfectly mature and is one of the best keeping varieties. A medium-early sort, ripening in October.

15027. *Iteema*, or *Ytima.*

A third-class "soft" variety; fruit slightly over 2 inches long, about one-half as wide, widest at or near the middle, rounded at the base, somewhat pointed and conspicuously unsymmetrical at apex, not keeping its shape well when preserved, chestnut brown, with a slight purple tinge when ripe, the surface shining, the flesh over 2 lines thick, extremely soft, the seed nearly one-half as long as the fruit, about two-fifths as wide as long, chestnut colored.

A very handsome date, with sirupy, translucent flesh, extremely sweet, rather insipid in flavor. Early ripening sort. Is eaten fresh.

15028. *Karooy.*

A third-class "soft" variety; fruit 1⅔ inches long, about one-half as wide, ovoid, narrowed from near the base to the rounded apex, keeping its shape fairly well when preserved, bay colored when ripe; skin, where loose, olive brown; the flesh about 1½ lines thick, rather tough; the seed about five-eighths as long as the fruit, about one-third as wide as long. The branches and stalks of the fruit clusters are orange colored.

Flesh rather tough, moderately sweet, flavor agreeable, similar to that of the "dry" dates.

15029. *Kenta.*

A first-class "dry" date, fruit 1⅓ to 1⅔ inches long, about one-half as wide, narrowed from the middle or above it to the broad apex, dull bay colored when ripe, much of the skin loosened in large blisters in the ripe fruit, the flesh 1½ to 2 lines thick, the seed four-sevenths to five-eighths as long as the fruit, rounded at both ends, light brown.

The leaves of this variety are rather broad, with numerous long, narrow leaflets. The light-orange stalks of the fruit clusters are stout and horizontal or ascending, and so short that with the bunches they do not equal the leafstalks. The clusters themselves are short, thick, and densely crowded with fruit.

One of the most highly esteemed and widely grown of the dry dates found in Tunis. The fruit is of medium size, the flesh rather thin, becoming quite firm, altho not very dry. The surface is clean and dry even when the fruit is quite ripe. It is not sirupy, altho pleasantly sweet, and can be eaten in quantity without cloying. The flavor is very agreeable, wholesome, and of the nutty quality characteristic of most dry dates. One of the best of the dry dates in keeping quality. Is a comparatively early-ripening variety, maturing about the middle of October and perhaps earlier. One of the two most productive varieties, said to give an abundant crop every year. Said to be the most salt-resistant variety in high-lying, well-drained land.

15030. *Kenteeshy*, or *Kentichi.*

A third-class "dry" variety; fruit about 1½ inches long, slightly more than one-half as wide, oblong or slightly obovoid; dull bay when ripe, the skin remaining yellow; the flesh 1 to 2½ lines thick, becoming hard and dry; the

15000 to 15210—Continued.

seed about two-thirds as long as the fruit, one-third to two-fifths as wide as long, broad and rounded at both ends. The stalks and branches of the fruit clusters are dull orange. The stalks are curved, forming nearly a semicircle, but do not hang down below the foliage.

Fruit is small, thin of flesh, and becomes hard and dry almost before it has lost its astringency. It ripens toward the end of October and beginning of November. Moderately sweet and rather tasteless. Yields heavily, being one of the most productive varieties found in Tunis, and is said to give a good crop every year. Reputed to be very alkali resistant.

15031. *Khadraya.*

A "dry" date; fruit 35 to 40 mm. long, 17.5 mm. wide, oblong, narrowed at the apex, bright orange before maturity, dull light brown when ripe; seed large, light brown. Branches of fruit clusters bright orange. Very sweet, with a pleasant flavor. Ripens in October.

15032. *Khalt* (?).

15033. *Khalt Boo Fagoos.*

A "soft" date; very similar to Boo Fagoos, 42.5 mm. long, 25 mm. wide, generally more or less obovoid, maroon colored when ripe, skin much folded; flesh very firm; seed large. Branches of fruit clusters light orange.

Moderately sweet, with a fine flavor of the Horra type.

15034. *Khalt Deglaowia.*

A second-class date of the "soft" type; fruit 1⅔ to 1¾ inches long, about one-half as wide, egg-shaped, narrowed from about the middle to the rounded apex, keeping its shape well when preserved, dark maroon purple when ripe, much of the skin loosened into soft blisters; the flesh about 2 lines thick, firm yet tender; the seed about two-fifths as long as the fruit, about one-third as wide as long, cinnamon brown. The stalks and branches of the fruit clusters are light yellow.

The fruit is rather small, with fairly thick, firm flesh. The fine flavor suggests that of Deglet Noor, which it resembles also in the shape of the fruit and the maize-yellow color of the branches of the clusters.

15035. *Khalt Gama.*

"Gama" means wheat, and is said to refer to the color of the fruit.

15036. *Khalt Hameed.*

A third-class "soft" variety; fruit 1⅜ inches long, about one-half as wide, ellipsoidal, generally slightly narrowed at both ends, keeping its shape well when preserved, bright maroon when ripe; the flesh 1½ lines thick, rather firm, not very sugary; the seed smooth, five-eighths as long as the fruit, about two-fifths as wide as long, widest above the middle.

15037. *Khalt Harraowia.*

A second-class "soft" date; fruit 1⅞ to over 2 inches long, narrowed from near the base to the somewhat pointed apex, keeping its shape well when preserved, dark-maroon purple when ripe; the flesh 2 to 3 lines thick, firm yet tender, very sugary; the seed one-half to five-ninths as long as the fruit, about one-third as wide as long. The branches of the fruit clusters are orange colored. The crown of foliage is well developed, the leaves large, and the leaflets long and numerous.

The large, handsome fruit somewhat resembles that of Horra, both in appearance and flavor. The flesh is copious, firm yet tender, and contains a great deal of sugar.

15038. *Khalt Kebeer.*

A fine, large, reddish brown "soft" date, with small seed, preserving admirably; flavor excellent.

15039. *Khalt Kentaowia.*

Occurs in the Jerid; apparently not uncommon at Tozer.

15000 to 15210—Continued.

15040 *Khalt Mooashem.*

A second-class "soft" date; fruit 1⅜ to 1⅞ inches long, about one-half as wide, egg-shaped, narrowed from about the middle to the rounded apex, keeping its shape perfectly when preserved; dark prune purple when ripe, the skin mostly adhering very closely to the flesh, conspicuously marked with transverse and longitudinal scars; the flesh about 2 lines thick, firm yet tender; the seed about one-half as long as the fruit, nearly one-half as wide as long, broadest near the middle, light brown, rough. The branches of the fruit clusters are bright orange.

The excellent fruit is characterized by its dark prune color, curiously scarred skin, copious soft flesh, and very sweet, highly attractive flavor. Apparently keeps perfectly.

15041. *Kharooby*, or *Kharroubi.*

A third-class "soft" variety; fruit about 2 inches long, less than two-fifths as wide, oblong, often somewhat wider near the apex than elsewhere, between bay and maroon colored when ripe, the surface shining; the skin conspicuously loosened and remaining light yellow; the flesh 1 to 2 lines thick, rather soft and dark colored; the seed nearly three-fifths as long as the fruit, one-third as wide as long, generally somewhat curved. The stalks and branches of the fruit clusters are orange colored.

Flesh of the ripe fruit of the consistency of jelly, moderately sweet, agreeable in flavor, resembling Lagoo. Said to preserve well. Ripens in October.

15042. *Kseba*, or (?) *Kessebi.*

A second-class "dry" variety; fruit about 1½ inches long, two-thirds as wide, ovoid or oblong-ovoid, widest below the middle, purplish maroon or bay when ripe; the flesh 2 to 2½ lines thick, firm but tender; the seed very nearly two-thirds as long as the fruit, two-fifths as wide as long, russet brown. The branches of the fruit clusters are deep orange. The foliage is characterized by having few spines and these are slender and weak.

The fruit, which preserves well, is very sweet and well flavored, in the latter respect being intermediate between Horra and Lagoo. Its fruits ripen in October.

15043. *Lagoo.*

A second-class "soft" date; fruit nearly 2 inches long, four-ninths as wide, oblong, tapering slightly to the apex, more or less curved, bay to light maroon colored when ripe, the surface somewhat shining, the flesh about 2 lines thick, rather tough, dark colored; the seeds slender, three-fifths to two-thirds as long as the fruit, two-sevenths to one-third as wide as long, russet brown, its surface roughened with fine wrinkles. The stalks and branches of the fruit clusters are orange colored, the crown of foliage is rather small, the leaves short and rather thick, with long, rather wide leaflets.

One of the earliest kinds; said to ripen by the middle of September. The fruit is of medium length, narrow, and dark colored when ripe. The flesh is rather thin, but soft, very sweet, and of an agreeable, characteristic flavor, somewhat resembling Rhars. It keeps well.

15044. *Lemsy.*

A second-class "dry" date; fruit 1½ to 1¾ inches long, about one-half as wide, elliptical in outline, not conspicuously narrowed toward the apex, often slightly curved, dull purplish maroon when ripe; the flesh 1 to 2 lines thick, becoming very firm and dry; the seed about two-thirds as long as the fruit, generally one-third as wide as long. The branches of the fruit clusters are orange colored.

This is a small, thin-fleshed dry date, sometimes preserved, but usually eaten fresh and even before it is perfectly ripe, as the flesh soon becomes dry and hard. It is deliciously sweet and has a fine flavor, tasting somewhat like chestnuts. Said to mature at the end of August.

15045. *Menakher.*

A first-class date of the "soft" type; fruit 2 to 2⅓ inches long, about one-half as wide, oblong, broad, and rounded at both ends, keeping its shape well when preserved; brownish maroon when ripe; the flesh 2 to 2½ lines thick;

15000 to 15210—Continued.

the seed broad at both ends, about one-half as long as the fruit, one-half as wide as long, very rough.

The leaves are long and broad, and rather stiff and heavy, crowded with very numerous long leaflets, and their stalks are armed almost thruout their length with long, stout spines. The fruit clusters are short and dense, their stalks bright yellow, rather short, stout, and only moderately curved, so that the bundles do not hang down below the leaves as in the Deglet Noor, but are almost hidden by the foliage.

This produces fruit that is thought by many of the natives, and even by some of the few Europeans who have tasted it, to surpass the Deglet Noor; is at least equal in quality to the Deglet Noor, which it considerably resembles in flavor. In size Menakher dates are 1½ to nearly 2 times as large as those of the Deglet Noor variety; in color they are generally darker. The seed, tho thick, is short in proportion to the length of the fruit. It is very different in appearance from that of the Deglet Noor. The thick, translucent flesh, altho soft and sirupy, becomes firm when preserved, just as does that of the Deglet Noor. If preserved with any care Menakher dates keep their shape admirably. The skin does not become sticky but remains dry and clean, which is a very desirable property in a dessert fruit. An objectionable feature is the strong development of the white, stringy core. This diminishes perceptibly, however, in thoroly ripe fruit. The consensus of opinion is that in point of appearance, cleanness of skin, keeping quality, and delicacy of flavor the Menakher dates surpass the Deglet Noor, while the latter are superior in the crisper texture of the flesh and small development of the stringy core, or "rag."

This variety ripens its fruits in the latter part of October. It is said to yield little during the first few years after the offshoots are planted, but afterwards surpasses the Deglet Noor in yield, one palm producing sometimes 220 pounds of dates.

15046. *Mokh Begry*, or *Moukh Begri.*

A second-class "soft" variety; fruit 1⅓ to 1½ inches long, about three-fourths as wide, broadest at the base, and narrowed thence to the broad, rounded apex, flattened on the sides, bright bay colored when ripe; the flesh very soft, about 1½ lines thick, rather dark colored, translucent; the seed light brown, one-half to two-thirds as long as the fruit, about twice as long as wide, rounded at both ends. The stalks and branches of the fruit clusters are light orange.

The trees are said not to bear heavily. The dates are rather small and have an unusual shape. The translucent flesh is very soft, but the fruit is said to preserve well. It is very sweet and of delicious flavor, resembling and perhaps equaling the Deglet Noor. Fruit ripens in the latter part of October.

15047. *Okht Ammary.*

Said to resemble Ammary, but to be larger. Reported to ripen at the end of September and not to keep well.

15048. *Okht Fteemy.* (French, *Oukht Ftimi.*)

A second-class "soft" date; fruit 2 to 2⅕ inches long, about two-fifths as wide, oblong, straight, somewhat pointed at the apex, deep purplish maroon when ripe, the surface shining; the flesh 2½ to 3 lines thick, soft; the seed slender, about one-half as long as the fruit, only two-sevenths as wide as long; dark brown. The stalks and branches of the fruit clusters are rich orange. The many fruit clusters are short-stalked and almost hidden by the foliage.

The very handsome fruit is longer and more slender than that of Fteemy, and is often brighter colored, but is otherwise very similar. In regard to flavor, no difference could be detected. Altho very soft and sirupy, the fruits preserve well. Okht Fteemy palms give a good crop every year and are very productive. These dates are not generally ripe before November. Among the most alkali-resistant varieties.

15049. *Remta.*

A third-class "dry" date; fruit 1½ to 1⅔ inches long, about one-half as wide, oblong, somewhat pointed at the apex, generally distinctly constricted a little above the base, dark maroon colored when ripe; the flesh about 1 line thick, rather tough; the seed one-half to two-thirds as long as the fruit,

15000 to 15210—Continued.

a little less than one-half as wide as long. The stalks and branches of the fruit clusters are bright orange.

Flesh firm, moderately sweet, with an agreeable flavor resembling that of Thaby. Said to ripen early.

15050. *Rhars.* (Sometimes known as *Rhars* (or *Ghars* or *Cheress*) *Mettigui.*)

A second-class tho well-known date of the "soft" type; fruit 1⅔ to over 2 inches long, two-fifths to four-ninths as wide, oblong or inversely egg-shaped, bay colored when ripe, its surface somewhat shining; the flesh 2 to 4 lines thick, very soft; the slender seed five-eighths to three-fifths as long as the fruit, two-sevenths to one-third as wide as long, broad and rounded at both ends. The ripe fruit does not keep its shape well when preserved. The stalks and branches of the fruit clusters are bright orange. The trunk is stout and the foliage luxuriant, numerous long leaves being crowded with long, broad leaflets.

One of the earliest. Said to begin to ripen as early as the end of July. The fruit is large, bay colored when ripe, with copious soft, sirupy, translucent flesh, very sweet and rich-flavored. Not one of the best-keeping sorts.

15051. *Sba Aroossa.*

Said to be rare and of fairly good quality. Reported to be a long, slender date, ripening in October and not keeping well.

15052. *Sayba Boo Dra.*

A third-class "soft" variety; fruit 2 to over 2½ inches long, about three-sevenths as wide, oblong, somewhat pointed at the apex, usually curved; prune purple when ripe; the surface rather dull; the flesh 3 and 3½ lines thick, rather firm; the slender seed about one-half as long as the fruit and two-sevenths to one-third as wide as long. The stalks and branches of the fruit clusters are bright orange colored.

The largest of the Tunisian varieties. Flesh thick, rather tough. Flavor agreeable, suggesting Boo Fagoos. Ripens about the end of October.

15053. *Tafazween.* (Also *Tafazaouine*, or *Tafezoween.*)

A first-class "soft" date; fruit 2 to 2¼ inches long, about two-fifths as wide, oblong, tapering slightly from base to apex, bright bay colored when ripe; the skin conspicuously marked with short linear scars; the flesh 1½ to 2 lines thick; the slender seed about three-fifths as long as the fruit.

The handsome fruit is easily recognized by its long, narrow shape, bright-bay color, and curiously marked skin. It is said to ripen in October. The flesh is soft and translucent, like that of the Deglet Noor. It is very sweet, and of excellent flavor.

15054. *Tantabousht*, or *Tantaboucht.*

A third-class "soft" date; fruit nearly spherical, usually somewhat wider than long, 1 to 1½ inches in greatest diameter, usually widest above the middle, slightly deprest at apex, not keeping its shape well when preserved, very dark brown purple (almost black) when ripe; the flesh 3 to 5 lines thick, very soft and dark colored; the large seed two-thirds to four-fifths as long as the fruit, one-half to two-thirds as wide as long; smooth. The stalks and branches of the fruit clusters are deep orange colored.

A date remarkable for its round shape and very soft, almost black flesh. Flavor peculiar and characteristic, even perfectly ripe fruit retaining a certain amount of astringency.

15055. *Tenaseen.* (French orthography, *Tanessin*, or *Tenassine.*)

A third-class "soft" variety; fruit 1⅔ to 1⅞ inches long, about one-half as wide, oblong, not keeping its shape well when preserved, black when ripe; the flesh very soft, nearly black; the seed five-ninths to five-eighths as long as the fruit, about one-third as wide as long, rather dark brown.

The flavor of the very sweet, soft, dark-colored flesh suggests Tozer Zaid Safra, but is more agreeable. Is said to ripen in October.

15056. *Thaby*, or *Dzhabi.*

A second-class "dry" variety; fruit 1⅔ inches long or slightly longer, about one-half as wide; oblong, often slightly constricted a little above the base, some-

15000 to 15210—Continued.

what pointed at apex; bright reddish brown when ripe; the flesh 1 to 1½ lines thick, rather tough, the dark-colored outer zone apparently much thicker than the white inner portion. Seed about three-fifths as long as the fruit, rather slender. The stalks and branches of the fruit clusters are rich orange colored.

It is one of the handsomest of the "dry" dates, and one of the most attractive when preserved, keeping perfectly its shape and its beautiful, warm reddish brown color. It has an agreeable, wholesome flavor, and can be eaten in quantity without cloying. It matures in October.

15057. *Towadant.*

Fruit said to be very large and long, yellow, and of good flavor, ripening at the same time as Fteemy and keeping well.

15058. *Tozer Zaid Khala.*

A third-class "soft" variety; fruit 1½ to 1¾ inches long, three-fifths to two-thirds as wide; obovoid or oblong, broad and rounded at apex, not keeping its shape well when preserved; black when ripe; the flesh about 2 lines thick, very soft and sirupy, nearly black; the seed about two-fifths as long as the fruit, about two-fifths as wide as long; dark brown.

Less common than Tozer Zaid Safra, which it very closely resembles in appearance and flavor.

15059. *Tozer Zaid Safra.*

A third-class "soft" date; fruit 1½ to 1⅔ inches long, generally four-sevenths to two-thirds but sometimes only one-half as wide as long; oblong or oblong egg-shaped, widest near the middle, broad and rounded at the apex, not keeping its shape well when preserved; the flesh 1½ lines thick, extremely soft and sirupy; nearly black; the relatively large seed about one-half as long as the fruit, two-fifths to one-half as wide as long, light brown.

Flavor characteristic, much appreciated by the natives. Generally eaten fresh, but sometimes preserved for a short time. Yields heavily. Fruit ripens in the latter part of October. Said to be one of the four salt-resistant varieties.

15060. *Tronja*, or *Troundja.*

A first-class "soft" date; fruit perfectly round, or nearly so, 1½ to nearly 2 inches in greatest diameter; maroon to prune purple when ripe; the flesh 4 to 5 lines thick, very sugary yet firm; the seed very thick, six-tenths to seven-tenths as long as the fruit and about three-fifths as long as wide; much furrowed. The foliage is dense, the leaves wide, crowded with leaflets, and drooping gracefully at the ends.

The fruit, which ripens in October, is remarkable for its large size, the thickness of its flesh, and its globular shape. The short, very thick seed is also characteristic. The flesh is very firm and even somewhat tough, extremely sweet and very rich flavored, the flavor suggesting that of the Fteemy. Tronja dates can not be eaten in large quantities, as their richness soon cloys, but as a dessert fruit they are very promising.

15061. *Zrai.*

Fruit said to resemble Deglet Noor in color.

15062. *Zekry.*

A second-class "soft" date; fruit 1½ to near 1⅔ inches long, about one-half as wide, obovoid, keeping its shape fairly well when preserved, bay to maroon when ripe; the flesh about 1½ lines thick, moderately soft; the seed about four-sevenths as long as the fruit, about two-fifths as wide as long. The stalks and branches of the fruit clusters are orange colored.

When perfectly ripe the flesh, altho rather thin, is soft and very sweet. The flavor is characteristic, suggesting both chestnuts and persimmons. Said to yield heavily.

15063. *Menakher* (?).

15064. *Menakher* (?)

15065 to 15210.

One hundred and forty-six unidentified palms of Mr. Kearney's shipment, which were planted in the Date Garden at Mecca, Cal.

15211. PHOENIX DACTYLIFERA. **Date.**

From Winters, Cal. Received thru Prof. A. V. Stubenrauch in the spring of 1904. A large male date palm.

15212. PHOENIX DACTYLIFERA. **Date.**

From Pomona, Cal. Secured by Prof. A. V. Stubenrauch, from the substation at Pomona, Cal., and transplanted to the Date Garden at Mecca, Cal., in 1904 and 1905.

15213 to 15224. PHOENIX DACTYLIFERA. **Date.**

From Siwah Oasis, Egypt. Received thru Mr. H. I. Rankin, Fayum, Egypt, March 23, 1905, in New York.

A collection of date suckers secured by Mr. Rankin, who made a trip to the oasis of Siwah in February, 1905, to get them. The Arab names are those secured by Mr. Rankin.

15213. *Gazaley.*
15214. *Frahee.*
15215. *Saydy.*
15216. *Roghm Gazal.*
15217. *Kayby.*
15218. *Azawy*, or *Widy.*
15219. Male palms.
15220. *Saydy.*

"Dried dates from the Oasis of Siwah. According to Cailliaud they are the third in quality of the Siwah dates. While fresh these are packed in baskets to be exported and sold in Egypt." (*Rankin.*)

15221 to 15224. (Numbers assigned to four palms of this shipment which arrived without labels.)

15225 to 15313. PHOENIX DACTYLIFERA. **Date.**

From Bassorah, Arabia. Received thru Mr. H. P. Chalk, American consular agent, Bassorah, June 7, 1905.

A collection of 209 date suckers purchased from the Arabs by Mr. Chalk in Bassorah. The Arab names are those sent in by Mr. Chalk.

15225. *Bery.*
15226. *Helawy.*
15227. *Hevezy.*
15228. *Sayer.*
15229. *Gunamy.*
15230. *Khedrawy.*

15231 to 15313. (Numbers assigned to 83 palms which lost their labels in transit.

15314. PHOENIX DACTYLIFERA. **Date.**

From Marseille, France. Received thru Champagne Brothers (Limited), August 5, 1905.

Deglet Noor. Seed.

15315 to 15332.

From Tokyo, Japan. Received thru J. Ikeda & Co., seed growers, Waseda, August 14, 1905.

15315 to 15320. BRASSICA RAPA. **Turnip.**

15315. *Shogoin.*
15316. *Tennoji.*
15317. *Omi-Kabu.*
15318. *Naga-Kabu.*
15319. *Hino.*
15320. *Kokabu.*

15315 to 15332—Continued.

15321 to 15332. Raphanus sp. **Radish.**

15321. *Nerima Marushiri.*
15322. *Nerima Shirihoso.*
15323. *Nerima Chiunaga Marushiri.*
15324. *Miyashige.*
15325. *Horyo.*
15326. *Extra Early Kunichi.*
15327. *Tokkuri.*
15328. *Shogoin.*
15329. *Early Sakurashima.*
15330. *Moriguchi.*
15331. *Kurama.*
15332. *Late Sakurashima.*

15333 to 15371.

From Pretoria, Transvaal. Presented by Prof. J. Burtt Davy, government agrostologist and botanist, Transvaal Department of Agriculture. Received August 14, 1905.

Forage grasses. The numbers in parentheses are those assigned by Professor Davy.

15333. (Natal redtop.) From Natal. (291/05)
15334. Aristida sp. From Natal. (288/05)
15335. (Native grass.) From Natal. (305/05)
15336. (Natal redtop.) From Natal. (239/05)
15337. Chloris virgata. From Natal. (290/05)
15338. Eragrostis sp. From Natal. (289/05)
15339. (Native grass.) (292/05)
15340. Chloris virgata elegans (?). (233/05)
15341. Setaria sp. (300/05)
15342. Eragrostis sp. (295/05)
15343. (Native grass.) (386/05)
15344. Setaria aurea. From Natal. (299/05)
15345. (Native grass.) (297/05)
15346. (Native grass.) (389/05)
15347. (Native grass.) (423/05)
15348. (Native grass.) (520/05)
15349. (Native grass.) (306/05)
15350. (Native grass.) (471/05)
15351. (Native grass.) (467/05)
15352. (Native grass.) (469/05)
15353. (Native grass.) (298/05)
15354. (Native grass.) (464/05)
15355. Chloris sp. (403/05)
15356. (Native grass.) (472/05)
15357. (Native grass.) (466/05)
15358. Eragrostis sp. From Natal. (289/05)
15359. Eragrostis sp. (390/05)
15360. (Native grass.) (429/05)
15361. (Native grass.) (396/05)
15362. Paspalum sp. (234/05)
15363. (Native grass.) (232/05)
15364. Eragrostis curvula valida. (307/05)
15365. (Native grass.) (425/05)
15366. Setaria sulcata. From Natal. (312/05)
15367. (Native grass.) (388/05)
15368. (Native grass.) (387/05)
15369. (Native grass.) From Natal. (315/05)
15370. (Native grass.) (308/05)
15371. (Native grass.) (296/05)

"Several of the species of Setaria and Eragrostis are valuable forage grasses. *Setaria sulcata* (S. P. I. No. 15366) is one of our best forage grasses, but requires a warm climate. It will stand some frost, however, as the roots have not been killed with a temperature of + 18° F. *Setaria aurea* (S. P. I. No. 15344) is a valuable hay grass. S. P. I. No. 15340 and S. P. I. No. 15337, forms of *Chloris virgata*, tho annual, are of great value here, making an excellent and sweet hay. This grass ought to be tried in Arizona, New Mexico, and southern California, and I am sending seed to the Arizona and California stations." (*Davy.*)

15372. COLOCASIA ANTIQUORUM ESCULENTUM. **Taro.**

From Mayaguez, P. R. Received thru Mr. H. C. Henricksen, Agricultural Experiment Station, August 15, 1905.

"This is one of the 40(?) varieties of taro cultivated in Hawaii. Roots of this variety, called *Japanese*, were sent from the Hawaiian Experiment Station to the Porto Rico Experiment Station in 1903. It does not compare favorably in Porto Rico with the Trinidad taro of the same type." (*Barrett.*)

15373. COLOCASIA ANTIQUORUM ESCULENTUM. **Taro.**

From Mayaguez, P. R. Received thru Mr. H. C. Henricksen, Agricultural Experiment Station, August 15, 1905.

"This variety is known as the *Royal* taro in Hawaii. It is one of the few true taros having purplish roots. The Porto Rico Experiment Station received this variety in 1903 from the Hawaiian Experiment Station, but it did not grow satisfactorily in the testing plats at Mayaguez, P. R." (*Barrett.*)

15374. ARRACACIA ESCULENTA. **Apio.**

From Ponce, P. R. Received thru Mr. J. W. van Leenhoff, August 15, 1905.

"Tho this plant is not cultivated in Porto Rico so widely as in Venezuela, it always sells for a good price in the local market. It grows better in elevated districts, preferring a cool, moist situation. Partial shade seems to be beneficial at low elevations. It should be treated like carrots." (*Barrett.*)

15375. PYRUS sp. **Pear.**

From Shanghai, China. Received thru Rev. J. M. W. Farnham, August 16, 1905.

15376. RUBUS sp. **Raspberry.**

From Shanghai, China. Received thru Rev. J. M. W. Farnham, August 16, 1905.

"A berry growing wild on the mountains about 150 miles southwest of Shanghai. The fruit is a little larger than the red raspberry which grows in New England, and has not quite so strong a raspberry flavor." (*Farnham.*)

15377 to 15422.

From Mayaguez, P. R. Received from Mr. H. C. Henricksen, of the Porto Rico Experiment Station, thru O. W. Barrett, August 15, 1905.

These varieties comprise a large part of the collection made by Mr. O. W. Barrett while botanist of that station.

15377. XANTHOSOMA sp. **Yautia.**

Guayamera Verde. "A dwarf yautia with pink tubers of first quality; not widely cultivated." (*Barrett.*)

15378. CALADIUM sp.

Brava. "A weed in fields. Leaves have a coppery luster. The grated yellow corm is used to kill maggots in sores on cattle." (*Barrett.*)

15379. XANTHOSOMA sp. **Yautia.**

Orqueta. "A small yautia with whitish petioles and pale leaves; the tuber is hard, yellow, and of second quality; cultivated in but few districts in Porto Rico." (*Barrett.*)

15380. XANTHOSOMA sp. **Yautia.**

"A yautia received from the Botanic Gardens, Aburi, Gold Coast, West Africa; it is apparently identical with one of the Jamaican varieties and was very probably introduced into Africa from the West Indies." (*Barrett.*)

15381. COLOCASIA sp. **Taro.**

Malanga 2. "Presented to the Porto Rico Experiment Station by Mr. E. André, of Trinidad." (*Barrett.*)

15377 to 15422—Continued.

15382. Colocasia sp. **Taro.**

Malanga. "Presented to the Porto Rico Experiment Station by Mr. E. André, of Trinidad." (*Barrett.*)

15383. Xanthosoma sp. **Yautia.**

"A yautia received from Trinidad, where it is known as the *Jamaica Tanier;* this variety, however, was not received in the collection from Jamaica." (*Barrett.*)

15384. Xanthosoma sp. **Yautia.**

"A semicultivated yautia sent from Guatemala by Mr. O. F. Cook; it appears distinct from any other known sort, but of little value as a crop." (*Barrett.*)

15385. Xanthosoma sp. **Yautia.**

Martinica. "A first-class yautia widely cultivated in Porto Rico, tho not observed in collections from other West India islands. It has the petioles blotched with rose, maroon, and cream, and the blades are dark green; the smallish tubers are oblong, yellow, and of a firm texture when cooked. Called *Quintal* and *Huevo* in some localities." (*Barrett.*)

15386. Xanthosoma sp. **Yautia.**

A first-class yautia obtained in Caracas, Venezuela, in 1903 by Mr. O. W. Barrett. "It attains a height of 5 feet and the largest tubers weigh from 1 to 2 pounds. This is a form of No. 15417 of Porto Rico, Trinidad, Belize, and Cuba; it may be considered the best of all known yautias." (*Barrett.*)

15387. Xanthosoma sp. **Yautia.**

Amarilla. "A common yautia in Porto Rico, prized for its drought-resisting and keeping qualities and highly nutritious yellow tubers; it is a small variety and very liable to fungous attacks." (*Barrett.*)

15388. Xanthosoma sp. **Yautia.**

Gengibrilla. "A second-class yautia from the Arecibo district of Porto Rico; the long, slender, pinkish tubers are of fair quality; it is one of the varieties of the peculiar flat-leaved *Manola* type." (*Barrett.*)

15389. Xanthosoma sp. **Yautia.**

Luquillo. "A yautia probably identical with No. 15417; cultivated at Cidra, P. R." (*Barrett.*)

15390. Xanthomosa sp. **Yautia.**

Islena. "A second-class yautia, not well known; it resembles No. 15388, but has short tubers and a different stooling habit. No. 32 of the Porto Rico Station's collection." (*Barrett.*)

15391. Xanthosoma sp. **Yautia.**

Malanga Amarilla. "A yautia received from the Cuban Agricultural Experiment Station; No. 5206 of said station's plant list." (*Barrett.*)

15392. Xanthosoma sp. **Yautia.**

Vino. "A dwarf yautia, widely cultivated in Porto Rico; the pink or purplish tubers are of excellent quality for table use but are not produced in sufficient quantity to be found on the market." (*Barrett.*)

15393. Xanthosoma (?) sp. **Yautia.**

Cimarrona. "An apparently undescribed species growing in ravines in Porto Rico; it flowers, but probably does not produce seed. The grated corms are used to kill maggots in sores on cattle or horses. (See No. 15378)." (*Barrett.*)

15394. Xanthomosa sp. **Yautia.**

Guayamera Colorada. "A common first-class yautia, apparently peculiar to Porto Rico; the mauve or purplish petioles and leaf veins distinguish this sort from all others except No. 15404. The elongated pink tubers are of good size and excellent quality. The leaves attain 6 feet in good soil." (*Barrett.*)

15377 to 15422—Continued.

15395. Colocasia sp. **Taro.**

Dasheen. A species of Colocasia, probably undescribed; brought from Trinidad in 1903 by Mr. O. W. Barrett. "This proves a most promising economic, since the tubers are ripened in six to nine months; it can be grown on a variety of soils; the yield in good soil is from 2 to 4 pounds to the hill. It resembles Nos. 15372 and 15373 in producing true tubers like a yautia instead of a large rhizome like a true taro." (*Barrett.*)

15396. Xanthosoma sp. **Yautia.**

White Eddoe. "Sent by Mr. E. André, Port of Spain, Trinidad." (*Barrett.*)

15397. Xanthosoma sp. **Yautia.**

"An excellent yautia sent by the Jamaica Department of Agriculture. (No. 2, Jamaica.)" (*Barrett.*)

15398. Xanthosoma sp. **Yautia.**

Amarilla. "A small Cuban yautia sent by the Estación Central Agronómica, Santiago de las Vegas, Cuba. Probably identical with No. 15387, but perhaps more resistant to fungous attacks." (*Barrett.*)

15399. Xanthosoma sp. **Yautia.**

Guagui. "A yautia sent by the Estacion Central Agronómica, Santiago de las Vagas, Cuba." (*Barrett.*)

15400. Xanthosoma sp. **Yautia.**

"A yautia identical [?] with No. 15394, but purchased from Reasoner Brothers, Oneco, Fla., as *Alocasia bataviensis.*" (*Barrett.*)

15401. Xanthosoma sp. **Yautia.**

"A yautia purchased from Reasoner Brothers, Oneco, Fla., as *Alocasia marshalli.* It yields a good-sized, edible tuber of the 'Rolliza' type." (*Barrett.*)

15402. Xanthosoma sp. **Yautia.**

Malanga Blanco. "A yautia received from the Estacion Central Agronómica, Santiago de las Vegas, Cuba." (*Barrett.*)

15403. Xanthosoma sp. **Yautia.**

"A fine yautia received thru the Jamaica Department of Agriculture. (No. 4, Jamaica.)" (*Barrett.*)

15404. Xanthosoma sp. **Yautia.**

Prieta. "A first-class yautia resembling No. 15394 as regards leaf coloring, but the tubers are orange yellow; a highly prized table variety, but not very productive." (*Barrett.*)

15405. Xanthosoma sp. **Yautia.**

Manola, or *Rolliza Ancha.* "A flat-leafed yautia not well known; the tuber is firm and yellow, but rather small." (*Barrett.*)

15406. Xanthosoma sp. **Yautia.**

"An excellent variety received from the Jamaica Department of Agriculture. (No. 5, Jamaica.)" (*Barrett.*)

15407. Xanthosoma sp. **Yautia.**

Punzera. "Probably identical with No. 15392." (*Barrett.*)

15408. Xanthosoma sp. **Yautia.**

Dominica. "A very choice variety of the *Amarilla* type, grown on the north side of Porto Rico; the tuber is in some respects the finest flavored and richest of all yautias." (*Barrett.*)

15409. Xanthosoma sp. **Yautia.**

"A first-class yautia received from the Jamaica Department of Agriculture. (No. 1, Jamaica.)" (*Barrett.*)

15337 to 15422—Continued.

15410. XANTHOSOMA sp. **Yautia.**

Isleña de Ponce. "A strong-growing yautia resembling No. 15392, but of two to three times the size. The tuber is of good flavor, pink, and is produced in fair quantity. Overstooling seems to be the principal fault of this variety." (*Barrett.*)

15411. XANTHOSOMA sp. **Yautia.**

Ysleña. "Received from the Estacion Central Agronómica, Santiago de las Vegas, Cuba. (No. 5207 of the Cuba station's list.)" (*Barrett.*)

15412. XANTHOSOMA sp. **Yautia.**

Belembe. "A wild or semicultivated yautia, probably *Xanthosoma hastifolium.* The young leaves of this species are preferred by the natives of Porto Rico for use (boiled) as a spinach. This plant flowers freely; it produces no tubers; height, 18 feet 2 inches." (*Barrett.*)

15413. ALOCASIA MACRORHIZA.

"This is semicultivated in some districts as a pig food; the large rhizomes are boiled to destroy the rhaphides." (*Barrett.*)

15414. XANTHOSOMA sp. **Yautia.**

Palma. "The largest of known Xanthosomas, tho of no great importance horticulturally. Urban considers this *X. violaceum*, but that species is usually considered as comprized by the purple-leaved forms, like Nos. 15394 and 15404. The nearly tuberless rhizome attains a length of 1 to 3 feet and a diameter of 3 to 6 inches. It is used for feeding pigs and poultry when boiled." (*Barrett.*)

15415. XANTHOSOMA sp. **Yautia.**

"A fine yautia, received from the Jamaica Department of Agriculture. (No. 6, Jamaica.)" (*Barrett.*)

15416. XANTHOSOMA sp. **Yautia.**

Quintal. "Probably identical with No. 15385. Named from its believed ability to produce 100 pounds of tubers per plant when very heavily fertilized. The rhizome is frequently eaten, tho not of so delicate a flavor and texture as the tubers." (*Barrett.*)

15417. XANTHOSOMA sp. **Yautia.**

Rolliza. "This is the best variety native to Porto Rico. It may be grown on a variety of soils. The yield is 2 to 4 pounds per hill. The tubers are of large size, white, mealy, and smooth. The rhizome is also eaten. This is undoubtedly *Xanthosoma sagittifolium* Schott. It occurs in Belize, Trinidad, and Cuba. A very similar form produces larger (?) tubers in Venezuela." (*Barrett.*)

15418. XANTHOSOMA sp. **Yautia.**

"A choice yautia, received from the Jamaica Department of Agriculture. (No. 3, Jamaica.)" (*Barrett.*)

15419. XANTHOSOMA sp. **Yautia.**

Blanca. "A second-class yautia, resembling No. 15417, but not so productive nor so early. The rhizome is poisonous, because of its content of calcium oxalate rhaphides. The tubers are more slender and rougher than those of the *Rolliza*, No. 15417." (*Barrett.*)

15420. XANTHOSOMA sp. **Yautia.**

"A yautia from Belize, probably identical with No. 15417." (*Barrett.*)

15421. XANTHOSOMA sp. **Yautia.**

"A yautia introduced into Porto Rico from Trinidad by the writer in 1903. It is very similar to No. 15417, but the tubers appear to vary slightly from yellowish white to pinkish white instead of being of the even white of *Rolliza.*" (*Barrett.*)

15422. XANTHOSOMA sp. **Yautia.**

Red Eddoe. Presented by Mr. E. André, Port of Spain, Trinidad. (*Barrett.*)

15423. Narcissus pseudo-narcissus. **Daffodil.**

From Santa Cruz, Cal. Received thru Mr. E. Leedham, of the Leedham Bulb Company, August 16, 1905.

15424. Mangifera indica. **Mango.**

From Lucknow, India. Received thru Mr. Robert Anderson, Lansdowne, Pa., August 21, 1905.

Bombay (?).

15425 to 15427.

From Bellingham, Wash. Received thru Mr. H. E. Juenemann, of this Department, August 21, 1905.

15425. Rosa sp.

15426. Rosa sp.

15427. Rubus spectabilis.

15428 and 15429. Vicia faba. **Horse bean.**

From Naples, Italy. Received thru Dammann & Co., August 18, 1905.

15428. *Vesce feverole des Champs.*

15429. *Vesce feverole petite.*

15430 to 15445.

From Bellingham, Wash. Received thru Mr. J. W. M. Smith, August 22, 1905.

15430 to 15434. Hyacinthus sp.

15435 to 15440. Narcissus spp.

15441 and 15442. Crocus sp.

15443 to 15445. Tulipa sp.

15446 to 15458.

From Clearbrook, Wash. Received thru Mr. George Gibbs, August 21, 1905.

15446 to 15456. Narcissus spp.

15457 and 15458. Hyacinthus sp.

15459. Narcissus tazetta alba.

From Alameda, Cal. Received thru Mr. George Rosmarin, Encinal Nursery, August 22, 1905.

15460 to 15474. Mexican plants.

From City of Mexico, Mexico. Received from Dr. J. N. Rose, August 25, 1905.

The numbers in parentheses are those of Doctor Rose's notes, which give the exact localities where the various plants were secured.

15460. (No. 1178/05.)
15461. (No. 1179/05.)
15462. (No. 1180/05.)
15463. (No. 1182/05.)
15464. (No. 1183/05.)
15465. (No. 1184/05.)
15466. (No. 1185/05.)
15467. (No. 1186/05.)
15468. (No. 1187/05.)
15469. (No. 1188/05.)
15470. (No. 1189/05.)
15471. (No. 1190/05.)
15472. (No. 1194/05.)
15473. (No. 1202/05.)
15474. (No. 1205/05.)

15475 to 15477.

From Paris, France. Received thru Vilmorin-Andrieux & Co., August 26, 1905.

15475. Caragana arborescens. **Siberian pea tree.**

15476 and 15477. Trifolium incarnatum. **Crimson clover.**

15476. *Extra Early Red.*

15477. *Early White.*

15478. LILIUM LONGIFLORUM EXIMEUM. **Easter lily.**

Seed grown in the Department greenhouse by Mr. G. W. Oliver. Numbered September 2, 1905.

15479. LILIUM LONGIFLORUM EXIMEUM GIGANTEUM. **Lily.**

Seed grown in the Department greenhouse by Mr. G. W. Oliver. Numbered September 2, 1905.

15480 to 15583. ORYZA SATIVA. **Rice.**

From Tanga, German East Africa. Presented by Prof. Dr. A. Zimmermann, of the Kaiserliche Biologische Landwirtschaftliche Institut, Amani, in the spring of 1905.

A collection of native rice varieties. The notes are those given by Doctor Zimmermann.

15480.

From Pangani, in the hills, 700 meters high.

15481.

Plant from January to March. Grown in Pangani, Mgera, northerly; 1,000 meters high; river valley of the Luhisgura (?).

15482.

From Pangani, Mohomorra, northward of Useguha Mountains; 400 meters high.

15483.

From Pangani Buguru, west of Useguha; altitude 600 meters; river valley of Msangazi.

15484.

From Pangani Bondei; altitude 300 meters.

15485. *Busanga* mixt with *Kwindimba.*

Glumes of *Busanga* are brown yellow; of *Kwindimba,* gray white. Kernel of *Busanga* is white; of *Kwindimba,* brown. From Lindi.

15486. *Kwindimba.*

From Lindi.

15487. *Namaria.*

From Lindi. Mixt with *Kwindimba.* Glumes brown; strong thick awn; kernel white with a reddish tinge.

15488. *Mkemzuri.*

From Lindi. Slender awn, white kernel. Glumes yellow gold.

15489. *Mpungarra.*

From Lindi. Glumes lighter than *Namaria* and *Mkemzuri.* Kernel white and large. Nos. 15485 to 15489 can be distinguished in cooking by specific odors. No one variety of soil is suitable for all conditions. In the valleys they are planted on moist or on sandy soils. In the high altitudes they are sown upon newly cleared land, but are uncertain and are dependent upon the rainfall.

15490. *Nondo.*

From Tanga district. Likes water.

15491. *Sifala.*

From Tanga district. Requires much water.

15492. *Nzurinwendo.*

From Tanga district. Requires much water.

15493. *Sona.*

From Tanga district. Requires much water.

15480 to 15583—Continued.

15494. *Ruwi.*

From Tanga district. Requires much water.

15495. *Mngoja.*

From Tanga district. Likes water.

15496. *Gundimba.*

From Mikindani.

15497. *Sungala.*

From Mikindani. Plant during December or January in black moist soil in valleys.

15498. *Kalimalia.*

From Matumbi Mariwe, in the district of Kilwa. Plant in heavy soil, giving much water and little sun. Matures in four and a half months after sowing.

15499. *Bungala.*

From Matumbi Mariwe, in the district of Kilwa. Plant in black soil, with much water and little sun. Matures in five months after sowing.

15500. *Seina.*

From Matumbi, near Mohora, in the district of Kilwa. Plant in black soil, with plenty of water and little sun. Matures in five and a half months after sowing.

15501. *Majeya Konoa.*

From Matumbi, near Kiswere, district of Kilwa. Requires good soil, much sun, and little water. Matures in three months.

15502. *Gundimba.*

From Matumbi, near Kiswere, district of Kilwa. Requires good soil, much sun, little water. Matures in three months.

15503. *Shindano.*

From Matumbi, near Kiswere, district of Kilwa. Requires good soil, much sun, little water. Matures in three months.

15504. *Ambari.*

From Tanga district. Likes water.

15505. *Mkarafun.*

From Tanga district. Likes water.

15506. *Mbenga Nonda.*

From Tanga district. Likes water.

15507. *Guniya.*

From Tanga district. Likes water.

15508. *Mounja Uniko.*

From Tanga district. Likes water.

15509. *Mchusi.*

From Tengra, near Saadani. Plant in November in sandy loam.

15510. *Majeya Fundi.*

From Tengra, near Saadani. Plant in November in sandy loam.

15511. *Majeya Fundi.*

From Tengra, near Saadani. Plant in November in sandy loam.

15512. *Kijegi.*

From Tengra, near Saadani. Plant in November in sandy loam.

15480 to 15583—Continued.

15513 to 15545.

(No data.)

15546.

Plant in wet soil. Grows after rainy season.

15547.

Inferior quality. Requires wet soil. Grows after the rainy season.

15548. *Bungala.*

Grown after rainy season in moist soil.

15549. *Kilimali, Akilimali, Halanaria, Tandika, Nyampendu, Halmilunda.*

Grown on lowlands, and with much rain will grow on the hills; from Mohora district, Rufiji.

15550. *Sena Kilbwali.*

Hill-land rice from Mohora district, Rufiji.

15551. *Sefala Bokianka Mbwego.*

Hill-land rice from Mohora district, Rufiji.

15552. *Kapora Nafiza Kunywa Zarakupata Mpungamuene.*

Hill-land rice from Mohora district, Rufiji.

15553. *Bungala.*

From Mohora district, Rufiji. Lowlands.

15554. *Kaneno Kanenwa.*

From Mohora district, Rufiji. Hills and dry lowlands.

15555. *Nugengwa.*

From Mohora district, Rufiji. Lowlands, without irrigation.

15556. *Kijicho.*

From Mohora district, Rufiji; lowlands or hills.

15557. *Nyenyenyati.*

Lowlands, Mohora district, Rufiji.

15558. *Schindano.*

Wet lowlands, Mohora district, Rufiji.

15559. *Harula.*

Lowlands, Mohora district, Rufiji.

15560. *Kibaba Rupie.*

Lowlands, Mohora district, Rufiji.

15561. *Mbweke.*

Lowlands, Mohora district, Rufiji.

15562. *Manjano.*

Hills and lowlands, Mohora district, Rufiji.

15563. *Kensi.*

Lowlands, Mohora district, Rufiji.

15564. *Swala.*

Lowlands, Mohora district, Rufiji.

15565. *Kuku.*

Lowlands, Mohora district, Rufiji.

15480 to 15583—Continued.

15566. *Ngohe.*

Hills and lowlands. Becomes vigorous. Often planted at the edge of the field.

15567. *Borakupala.*

From Morogoro. Opening of the rainy season is sown in damp soil.

15568. *Meli.*

From Morogoro. Plant at the commencement of the rainy season in moist lowlands or marshy places.

15569. *Malula* and *Marura.*

From Morogoro. Plant at the commencement of the rainy season in moist lowlands or marshy ground.

15570. *Sena.*

From Morogoro. Plant in moist ground at the commencement of the rainy season.

15571. *Rufiji.*

From Mahenge. Plant in rainy season in heavy, black, wet soil. From five to six months to mature.

15572. *Rigubaza.*

From Mahenge. Plant in rainy season in heavy, moist, black soil. Matures in five to six months.

15573 to 15583.

From Mahenge. Mature in five to six months. Plant in rainy season in heavy, moist, black soil.

15573. *Sena.*
15574. *Schindano.*
15575. *Halimaria.*
15576. *Kapemba.*
15577. *Kafinda.*
15578. *Kikalati.*
15579. *Ngumbo.*
15580. *Satari.*
15581. *Funga.*
15582. *Kingano.*
15583. *Miknambe.*

15584. LILIUM LONGIFLORUM EXIMEUM GIGANTEUM. **Lily.**

Seedlings raised in the Department of Agriculture greenhouses. Numbered September 1, 1905.

15585 to 15593. NARCISSUS sp. **Narcissus.**

From Guernsey, England. Received thru W. Mauger & Son, Brookdale Nurseries, August 21, 1905.

15594 to 15654.

From Haarlem, Holland. Received thru Mr. C. G. van Tubergen, jr., Zwanenburg Nurseries, September 5, 1905.

Miscellaneous bulbs.

15594. GLADIOLUS ALATUS.
15595 to 15645. TULIPA spp.
15646 to 15654. IRIS spp.

15655. AVENA SATIVA. **Oat.**

From Sherman, Tex. Received thru Mr. W. F. Sheldon, September 5, 1905.

15656. PERSEA GRATISSIMA. **Avocado.**

From Miami, Fla. Received thru Col. G. B. Brackett, from Prof. P. H. Rolfs, September 5, 1905.

15657. Narcissus tazetta. **Narcissus.**

From Santa Cruz, Cal. Received thru T. Thompson, florist, September 5, 1905.

15658 to 15667. Narcissus spp. **Narcissus.**

From Leyden, Holland. Received thru De Graaf Brothers (Limited), wholesale bulb growers, September 6, 1905.

15668 and 15669.

From Chicago, Ill. Received thru the A. Dickinson Co., September 6, 1905.

15668. Dactylis glomerata. **Orchard grass.**

15669. Phleum pratense. **Timothy.**

15670 to 15672.

From Budapest, Hungary. Received thru Mr. Frank Benton, of the Bureau of Entomology, September 7, 1905.

15670. Cucurbita sp. **Squash.**

"Large, green, very warty squash. Odd looking. Flesh yellow. Seed taken from squash on sale in market of Venice, Italy, August, 1905." (*Benton.*)

15671. Cucurbita sp. **Squash.**

"Small, grayish-green, flat squash on sale in market of Venice, Italy, August, 1905." (*Benton.*)

15672. Cucumis melo. **Muskmelon.**

"Muskmelon from market at Trieste, Austria, August, 1905. Probably brought up from Dalmatia. Sold under the name *Zate*. Medium to large-sized greenish yellow melon of fairly good quality; very warty, or covered with knobby excrescences." (*Benton.*)

15673 to 15682.

From the Office of Gardens and Grounds, turned over to the Office of Seed and Plant Introduction, September 8, 1905.

15673. Monstera deliciosa.
15674. Smilax medica.
15675. Sansevieria cylindrica.
15676. Clivia miniata.
15677. Maranta lineata rosea.
15678. Alocasia cuprea.
15679. Dieffenbachia seguine.
15680. Homeria discolor.
15681. Piper nigrum.
15682. Xanthosoma lindeni.

15683 to 15697.

From Sydney, New South Wales. Presented by Mr. J. H. Maiden, director and government botanist, Botanic Gardens. Received September 7, 1905.

15683. Acacia cunninghamii.
15684. Acacia cultriformis.
15685. Acacia neriifolia.
15686. Callitris calcarata.
15687. Callitris robusta.
15688. Casuarina stricta.
15689. Casuarina torulosa.
15690. Cordyline australis.
15691. Cordyline obtecta.
15692. Cordyline stricta.
15693. Ficus rubiginosa.
15694. Podocarpus elata.
15695. Sterculia acerifolia.
15696. Telopia speciosissima.
15697. Macadamia ternifolia.

15698 to 15744.

From Hillegom, Holland. Received thru R. Van der Schoot & Son, September 11, 1905.

15698 to 15709. Narcissus spp.
15710 to 15738. Tulipa spp.
15739 to 15743. Iris hispanica.
15744. Narcissus sp.

15745. PHYSALIS sp. **Ground cherry.**

From Lima, Peru. Received thru W. R. Grace & Co., September 11, 1905.

Capuli.

15746. LILIUM LONGIFLORUM EXIMEUM. **Easter lily.**

From Tarrytown, N. Y. Received thru F. R. Pierson & Co., September 11, 1905.

15747 to 15749. THEOBROMA CACAO. **Cacao.**

From Trinidad, British West Indies. Received thru Prof. J. H. Hart, Trinidad Botanical Gardens, September 11, 1905.

15747. *Calabacillo.*

15748. *Forastero.*

15749. *Criollo.*

15750. PISUM sp. **Pea.**

From Gyangtse, Tibet. Received from Captain O'Connor, of the British Indian army, thru Mr. M. A. Carleton, cerealist, September 8, 1905.

15751. BESCHORNERIA BRACTEATA.

From Nice, France. Received thru Mr. A. Robertson-Proschowsky, September 15, 1905.

15752.

From Richmond, Va. Received thru T. W. Wood & Sons, September 15, 1905.

Wood's Grain Pasture Mixture, said to be a mixture of wheat, barley, rye, winter turf oats, and hairy vetch.

15753 to 15758.

From Shanghai, China. Received thru Rev. J. M. W. Farnham, September 15, 1905.

Seeds obtained 150 miles southwest of Shanghai, except 15753.

15753. AMYGDALUS PERSICA. **Peach.**

15754. AMYGDALUS PERSICA. **Peach.**

15755. CUCUMIS MELO. **Muskmelon.**

15756. CUCUMIS MELO. **Muskmelon.**

15757. CUCUMIS MELO. **Muskmelon.**

15758. CITRULLUS VULGARIS. **Watermelon.**

15759 to 15761. ORYZA SATIVA. **Rice.**

From Kobe, Japan. Presented by Mr. Thomas F. McGrath, of the China and Japan Trading Company, of Kobe, Japan, thru Dr. W. H. McGrath, Delaware avenue and Market street, Camden, N. J., and Mr. T. F. Townsend, United States Weather Bureau, Philadelphia, Pa. Received August 1, 1905.

15759. Early glutinous rice. "Tastes better than ordinary rice." (*McGrath.*)

15760. Later glutinous rice.

15761. Early ordinary rice.

15762 and 15763.

From the greenhouses of the Department of Agriculture. Received September 18, 1905.

15762. HOMALOMENA WALLISI.

15763. DIEFFENBACHIA sp.

15764 to 15766.

From Hungary and Bulgaria. Secured by Mr. Frank Benton, of the Bureau of Entomology, and received September 19, 1905.

15764. CITRULLUS VULGARIS. **Watermelon.**

From Godollo. Small, round melon; dark green, with red flesh, thin rind, and brown seeds; small; quality excellent; quite sweet and juicy. Collected August 24, 1905. (No. 6.)

15765. CUCUMIS MELO. **Muskmelon.**

From Budapest. Small, yellowish green, closely netted, quite aromatic. Flesh green, quite juicy, tender, and of excellent quality. Seed from melon purchased on the market. (No. 7.)

15766. CITRULLUS VULGARIS. **Watermelon.**

From Sophia, Bulgaria. Yellow-cored, medium-sized, good quality. Flesh lemon yellow or light greenish yellow. (No. 9.)

15767 to 15772. NARCISSUS spp. **Narcissus.**

From Ettrick, Va. Received thru Poat Brothers, September 19, 1905.

15773 and 15774. NARCISSUS spp. **Narcissus.**

From Santa Cruz, Cal. Received thru Mr. E. Leedham, of the Leedham Bulb Company, September 21, 1905.

15775. ZEA MAYS. **Corn.**

From Adrianople, Turkey. Received thru Mr. Frank Benton, of the Bureau of Entomology, September 21, 1905.

"Small, orange-yellow flint corn, said to withstand drought well. Stalks grow about 4 feet tall. The region about Adrianople is a very dry one. (No. 10.)" (*Benton.*)

15776. CUCUMIS MELO. **Muskmelon.**

From Constantinople, Turkey. Received thru Mr. Frank Benton, September 21, 1905.

"Smooth skin, yellow outside; rather large, oval form; flesh greenish white, juicy and excellent flavor. (No. 11.)" (*Benton.*)

15777. OPUNTIA GYMNOCARPA. **Prickly pear.**

From Nice, France. Received thru Dr. A. Robertson-Proschowsky, September 22, 1905.

15778. ORYZA SATIVA. **Rice.**

From Macassar, Celebes. Received thru Mr. Karl Auer, United States consular agent, September 5, 1905.

15779. CAPRIOLA DACTYLON. **Bermuda grass.**

From New York, N. Y. Received thru J. M. Thorburn & Co., September 28, 1905.

15780. DIOSPYROS LOTUS. **Black jube.**

From Jamaica Plain, Mass. Received from the Arnold Arboretum, September 28, 1905.

15781. ADONIS AMURENSIS.

From London, England. Received thru William Cutbush & Son, Highgate Nurseries, September 28, 1905.

15782 to 15787. ARACHIS HYPOGAEA. **Peanut.**

From Marseille, France. Received thru Hon. Robert P. Skinner, United States consul-general, September 28, 1905.

15782. *First-class Java.* **15784.** *Java.*

15783. *Pondicherry.*

15785. *Gambia.*

"One of the best of the edible oil nuts from the West Coast of Africa." (*Skinner.*)

15786. *Ruffisque.*

"One of the best of the edible oil nuts from the West Coast of Africa." (*Skinner.*)

15787. *Chinese.*

"A low-grade nut for industrial oil only." (*Skinner.*)

15788. TRITICUM DURUM. **Macaroni wheat.**

From Fort Collins, Colo. Received thru Mr. O. B. Underwood, February, 1905.

15789 to 15796.

From Gotha, Orange County, Fla. Received thru Mr. H. Nehrling, Palm Cottage Experiment Gardens, September 30, 1905.

15789. ALOCASIA sp. (?).

15790. XANTHOSOMA MACULATUM. **Yautia.**

15791. COLOCASIA EUCHLORA (?). **Taro.**

15792. XANTHOSOMA sp. **Yautia.**

From Florida; said to have been cultivated by the Seminoles; common in old Florida gardens.

15793. XANTHOSOMA ROBUSTUM (?). **Yautia.**

15794. ALOCASIA VIOLACEA (?).

15795. COLOCASIA FONTANESII. **Taro.**

15796. COLOCASIA ILLUSTRIS. **Taro.**

15797 to 15802.

From Fairoaks, Cal. Received thru Mr. F. McMillan, October 2, 1905.

15797. AVENA SATIVA. **Oat.**

Belgian Winter. Grown from S. P. I. No. 9878.

15798. AVENA SATIVA. **Oat.**

Appler Rustproof. Grown from S. P. I. No. 11722.

15799. HORDEUM VULGARE. **Barley.**

Tennessee Winter. Grown from S. P. I. No. 11658.

15800. SECALE CEREALE. **Rye.**

Abruzzes. Grown from S. P. I. No. 10366.

15801. TRITICUM VULGARE. **Wheat.**

Fretes. Grown from S. P. I. No. 11714.

15802. TRITICUM VULGARE. **Wheat.**

Chul-bidai. Grown from S. P. I. No. 9131.

15803 to 15805.

From Mayaguez, P. R. Received thru the Agricultural Experiment Station, October 3, 1905.

15803. XANTHOSOMA sp. (?). **Yautia.**

"Probably identical with No. 15414." (*Barrett.*)

15803 to 15805—Continued.

15804. XANTHOSOMA SAGITTIFOLIUM. **Yautia.**

"From the Alta Vera Paz district of Guatemala. The yellow tubers seem to distinguish this from all other known sorts having reddish petioles." (*Barrett.*)

15805. DRACONTIUM ASPERUM. **"Guapa."**

"Resembles Amorphophallus, which was discovered on the upper Amazon and which appears to occur only in Porto Rico and Brazil. The large corm, when well matured, is cooked by the natives, and may be compared to squash in appearance, but has a strong flavor not usually relished at the first taste. The single leaf attains a height of 8 feet. The fetid effluvium of the flower is poisonous." (*Barrett.*)

15806. HYACINTHUS ORIENTALIS ALBULUS. **Hyacinth.**

From Boston, Mass. Received thru R. & J. Farquhar & Co., October 2, 1905.

15807 and 15808.

From Palm Springs, Cal. Received from Dr. Welwood Murray, thru Mr. T. H. Kearney, October 2, 1905.

15807. CHILOPSIS SALIGNA. **Desert willow.**

An ornamental shrub for desert regions.

15808. PARKINSONIA sp. **Palo verde.**

An ornamental desert shrub.

15809 to 15817.

From Hiroshima, Japan. Presented by Mr. J. T. Meyers. Received September 29, 1905.

15809. ERIOBOTRYA JAPONICA. **Loquat.**

15810. PRUNUS sp. **Japanese bush cherry.**

"These (15809 and 15810) are both nursery plants, the '*Usura*' (15810) probably thriving under such treatment as would be given young cherry trees." (*Meyers.*)

15811. BRASSICA sp. **Turnip.**

Shogo.

15812. BRASSICA PE-TSAI. **Pe-tsai cabbage.**

15813. BRASSICA sp. **Turnip.**

Mammoth Red.

15814. RAPHANUS sp. **Radish.**

Sakura.

15815. RAPHANUS sp. **Radish.**

Moriguchi.

15816. CUCURBITA sp. **Squash.**

Tropical.

15817. CUCURBITA sp. **Squash.**

Kyoto.

15818 to 15820. FEIJOA sp. **"Guayabilla."**

From Buenos Aires, Argentina. Received thru Dr. Carlos Spegazzini, botanist of the Department of Agriculture, October 5, 1905.

15818. *Large.*

15819. *Smooth* or *Manzana.*

15820. *Small* or *Winter.*

15821 to 15824.

From Trebizond, Asiatic Turkey. Secured by Mr. Frank Benton, of the Bureau of Entomology. Received October 2, 1905.

Seeds obtained from Mr. Dem. Ch. Papathopoulos, of Samsoun, Asiatic Turkey.

15821. HORDEUM sp. **Barley.**

"Said to be of superior quality; not used as a forage crop, and the grain exported for use in the manufacture of beer, being especially suited for this." (No. 12.)

15822 to 15824. PAPAVER SOMNIFERUM. **Opium poppy.**

15822. *White-seeded.*

Grown near Samsoun, on the south coast of the Black Sea, Turkey in Asia. (No. 13.)

15823. Mixt.

Grown near Samsoun, Turkey in Asia. (No. 14.)

15824. *Blue-seeded.*

Grown near Samsoun, Turkey in Asia. (No. 15.)

15825. ANDROPOGON SORGHUM. **Milo.**

From Mecca, Cal. Received thru Brauckman Brothers, August 7, 1905.

15826. FESTUCA GIGANTEA.

From Agricultural College, Mich. Received thru Dr. W. J. Beal, September 20, 1905.

15827. CHAETOCHLOA ITALICA. **Millet.**

From St. Louis, Mo. Grown by Mr. W. J. Magee in 1904. Received September, 1905.

"The grain of the Ainu Japanese people. This sample was grown from Ainu seed." (*Magee.*)

15828. SCHOENOCAULON OFFICINALE (?). **"Cebadilla."**

From Vera Cruz, Mexico. Received thru Hon. William W. Canada, United States consul, October 5, 1905.

15829. HORDEUM VULGARE. **Barley.**

From Manhattan, Kans. Received thru Mr. A. M. Ten Eyck, October 6, 1905.

Tennessee Winter.

15830. HORDEUM VULGARE. **Barley.**

From Westminster, Md. Received thru Mr. H. L. Rhinehart, October 6, 1905.

Tennessee Winter.

15831. AMYGDALUS COMMUNIS. **Almond.**

From Grazalema, near Ronda, Spain. Received thru Mr. David Fairchild, October 9, 1905.

"This almond, a single tree of which stands in the 'huerta' of Señor Félix Enríquez, is, altho small, the highest-priced almond raised in the region, and conforms in shape and texture to the *Jordan* almond of Malaga. Its unusually thin shell and especially delicate kernel should make it of special value in California, where the tendency of these introduced hard-shelled almonds seems to be to become larger and coarser. This almond may develop in California into a larger sized superior type of *Jordan* almond." (*Fairchild.*)

15832. AMYGDALUS COMMUNIS. **Almond.**

From Ubrique, near Villa Martin, Spain. Received thru Mr. David Fairchild, October 9, 1905.

"A thin-skinned, fine type, of which few trees exist in Ubrique." (*Fairchild.*)

15833 to 15837. AMYGDALUS COMMUNIS. **Almond.**

From Grazalema, near Ronda, Spain. Received thru Mr. David Fairchild, October 9, 1905.

Almonds in the shell, purchased of Señor Félix Enríquez. "These five types, coming probably from seedling trees, are valuable for the production of seedlings, which may be better adapted to Californian conditions than the Jordan almond previously imported." (*Fairchild.*)

15833. *Larga.*

15834. *Almendron.*

15835. *Malagueña.*

15836. *Fino.*

"The Fino type is similar to No. 15831, and is the highest-priced almond in Grazalema." (*Fairchild.*)

15837. *Mollar Chico.*

"Soft-shelled, very small almond, of delicious texture." (*Fairchild.*)

15838. TACCA PINNATIFIDA. **Fiji arrowroot.**

From Oneco, Fla. Received thru Reasoner Brothers, Royal Palm Nurseries, October 9, 1905.

15839 to 15843. OPUNTIA spp. **Prickly pear.**

From Seville, Spain. Received thru Mr. Ambrosio Eschauzier, October 9, 1905.

15839. *Españoles.*

"A variety said to yield abundantly fruits of good flavor; not so well suited for fences as the more spiny varieties." (*Eschauzier.*)

15840. *Americanos.*

15841. *Moscatel*, or *Malagueños.*

15842. *Tintillas*, or *Viejas.*

15843. *Franceses.*

"Nos. 15842 and 15843 are used for hedges more than for fruit, on account of their large size and spininess." (*Eschauzier.*)

15844 to 15848. NARCISSUS spp. **Narcissus.**

From Santa Cruz, Cal. Received thru the Leedham Bulb Company, October 7, 1905.

15849. COCHLEARIA OFFICINALIS. **Scurvy grass.**

From London, England. Received thru Barr & Sons, October 9, 1905.

The famous scurvy grass, which is one of the cruciferous order to which the cresses belong, is found in England in three varieties. Its habit is to grow near the seashore; consequently, it is almost the first plant which a suffering crew would find ready to hand on landing. It is seen along the muddy banks of rivers and on seashores, especially near Lymington, in parts of Wales, and in Cumberland. One variety grows on the Scotch mountains. It is not a "grass" in any sense, but an upright plant with spoon-shaped leaves and large bunches of white and rather pretty flowers. The small species found on the Scotch hills is the Greenland scurvy grass.

15850. OPUNTIA FICUS INDICA. **Prickly pear.**

From Catania, Sicily. Received thru Charles Beek, esq., manager for the Duke of Bronte, Castel di Maniace, October 10, 1905.

Reputed at Catania to be the best sort grown in Sicily; fruit very sweet; seed small, probably abortive; color, pale yellow.

15851. CYTISUS SCOPARIUS. **Scotch broom.**

From New York, N. Y. Received thru J. M. Thorburn & Co., October 10, 1905.

15852. CENTROSEMA PLUMIERI.

From Mayaguez, P. R. Received thru Mr. H. C. Henricksen, horticulturist of the Agricultural Experiment Station, October 10, 1905.

From a vine grown from seed brought from St. Vincent, British West Indies, in 1903, by Mr. O. W. Barrett, botanist and entomologist of the Porto Rico Experiment Station. "This plant is giving excellent results as a cover crop in both Porto Rico and Hawaii, and is worthy of trial in the Southern States." (*Barrett.*)

15853 to 15874.

From McPherson, Kans. Received thru Mr. L. A. Fitz, October 6, 1905.

15853. TRITICUM MONOCOCCUM. **Einkorn.**

Fourth crop from German seed. (C. I. No. 1781.)

15854. TRITICUM MONOCOCCUM. **Einkorn.**

Fourth crop from seed found mixt with oats, S. P. I. No. 3676. (C. I. No. 2226.)

15855. TRITICUM MONOCOCCUM. **Einkorn.**

First crop from S. P. I. No. 10474. (C. I. No. 2433.)

15856 to 15864. AVENA SATIVA. **Oat.**

15856. *Burt.*

Second crop from seed from Virginia Agricultural Experiment Station, Blacksburg, Va. (C. I. No. 293.)

15857. *Sixty-Day.*

Third crop from S. P. I. No. 5938. (C. I. No. 165.)

15858. *Red Algerian.*

Second generation from S. P. I. No. 10269. (No. C. I. 337.)

15859. *Texas Red.*

From Agricultural Experiment Station seed, Manhattan, Kans.

15860. *Danish.*

First generation from New Zealand seed, S. P. I. No. 12877.

15861. *Dun.*

First generation from New Zealand seed, S. P. I. No. 12878.

15862. *Sparrowbill.*

First generation from New Zealand seed, S. P. I. No. 12879.

15863. *Canadian.*

First generation from New Zealand seed, S. P. I. No. 12880.

15864. *White Tartar.*

First generation from New Zealand seed, S. P. I. No. 12881.

15865. TRITICUM SPELTA. **Spelt.**

Fourth generation from seed from Agricultural Experiment Station, Pullman, Wash. (C. I. No. 1772.)

15866. HORDEUM VULGARE. **Barley.**

Tennessee Winter. First generation from S. P. I. No. 11780. (C. I. No. 2577.)

15867. HORDEUM DISTICHUM NUTANS. **Two-row barley.**

Hanna. Third generation from S. P. I. No. 9133. (C. I. No. 226.)

15853 to 15874—Continued.

15868. SECALE CEREALE. **Rye.**

Fourth generation from Russian seed, obtained at the Paris Exposition. (C. I. No. 13.)

15869. SECALE CEREALE. **Rye.**

Fourth generation from Russian seed obtained at the Paris Exposition. (C. I. No. 1.)

15870 to 15874. TRITICUM VULGARE. **Wheat.**

15870. *Kharkof.*

Fourth generation from S. P. I. No. 7467. (C. I. No. 1583.)

15871. *Turkey.*

Fourth generation from seed from Harvey County, Kans. (C. I. No. 1558.)

15872. *Ulta.*

Fourth generation from S. P. I. No. 5638. (C. I. No. 1439.)

15873. *Crimean.*

Fourth generation from S. P. I. No. 5636. (C. I. No. 1437.)

15874. *Kharkof.*

Fourth generation from S. P. I. No. 5641. (C. I. No. 1442.)

15875. BROMUS PACIFICUS.

From Sitka, Alaska. Received thru Prof. C. C. Georgeson, Agricultural Experiment Station, October 13, 1905.

15876 to 15879. MUSA spp. **Banana.**

From Manila, P. I. Received thru Mr. William S. Lyon, Bureau of Agriculture, October 16, 1905.

15876. *Carinosa.*

15877. *Lacatan.*

15878. *La Gloria.*

15879. *Bumulan.*

15880. TAMARINDUS INDICA. **Tamarind.**

From Manila, P. I. Received thru Mr. William S. Lyon, Bureau of Agriculture, October 16, 1905.

15881. GARCINIA MANGOSTANA. **Mangosteen.**

From Port of Spain, Trinidad. Received thru Prof. J. H. Hart, Trinidad Botanical Department, October 21, 1905.

15882. KUNZEA POMIFERA.

Received by the Office of Grass and Forage Plant Investigations without definite information as to the sender, October 17, 1905.

"Dense, prostrate, sand-binding plant. Grows only on sand hammocks, near the seacoast (in South Australia). Bears large quantities of edible berries in clusters of five or six. *Muntries* of natives; *native apples* of whites. Fruits have the odor and taste of apples."

15883. OENOTHERA OVATA. **Evening primrose.**

From Santa Cruz, Cal. Received thru Mr. George J. Streator, October 17, 1905.

15884. BROMUS INERMIS. **Smooth brome-grass.**

From Chicago, Ill. Received thru Mr. A. Dickinson, October 16, 1905.

15885. HEVEA sp. **Para rubber.**

From Amherst, Lower Burma. Received thru Mr. G. N. Collins, of the Bureau of Plant Industry, October 19, 1905.

"These plants were grown from seed sent by Mr. W. S. Todd, Amherst, Lower Burma. The trees from which the seed came were doubtless grown from seed distributed thruout India by the British Government many years ago." (*Collins.*)

15886. DURIO ZIBETHINUS. **Durian.**

From Singapore, Straits Settlements. Presented by Mr. G. O. Blacker. Received October 19, 1905.

15887. (Undetermined.) **Bean.**

From Chehkiang, China. Presented by Dr. S. P. Barchet, of the American consulate, Shanghai. Received October 21, 1905.

Stock feed bean. "This bean is found on the market in the west of Chehkiang Province, and is worth further investigation. It is sown broadcast in rice fields about the time they are being drained, two or three weeks before harvesting. Horses and cattle are fond of this plant, i. e., they eat it greedily, green or cured, with or without the bean." (*Barchet.*)

15888. PANICUM FRUMENTACEUM. **Millet.**

From Kin-hua-fu, Chehkiang, China. Presented by Dr. S. P. Barchet. Received October 21, 1905.

"A valuable variety of small glutinous grain millet grown in the western part of Chehkiang. Used as fodder and for brewing a beer tasting like wine." (*Barchet.*)

15889. ALOCASIA sp.

From Mayaguez, P. R. Received thru Mr. D. W. May, of the Agricultural Experiment Station, October 24, 1905.

"A fine ornamental, having the leaves (both sides) and petioles of a shining-purple shade. Height, 3 to 5 feet. Rhizome very poisonous by reason of its rhaphides." (*Barrett.*)

15890 to 15925.

From Ukiah, Cal. Received thru Mr. Carl Purdy, October 23, 1905.

15890 to 15895. LILIUM spp.

15896 to 15904. HYACINTHUS sp.

15905 to 15925. TULIPA spp.

15926. PHASEOLUS RADIATUS. **Mung bean.**

From Augusta, Ga. Received thru the N. L. Willet Drug Company, October 21, 1905.

15927. CYTISUS PROLIFERUS ALBUS. **Tagasaste.**

From the Canary Islands. Presented by Capt. Rosendo Torras, Brunswick, Ga., thru Hon. W. G. Brantley. Received October 20, 1905.

15928. PINUS PARVIFLORA. **Pine.**

From Washington, D. C. Received October 24, 1905.

Seed collected from a tree growing in the grounds of the United States Department of Agriculture.

15929. CITRULLUS VULGARIS. **Watermelon.**

From Dzansoul, Caucasus, Russia. Received thru Mr. Frank Benton, of the Bureau of Entomology, October 24, 1905.

"Grown at an altitude of 4,000 feet. Large, yellow-cored, slightly oval, with light-green skin and thin rind. (No. 16.)" (*Benton.*)

15930. CITRULLUS VULGARIS. **Watermelo**

From Dzansoul, Caucasus, Russia. Received thru Mr. Frank Benton, Octobe 24, 1905.

"Alternate stripes of dark and light green, round, good quality. Small, yellow cored. Grown at altitude of 4,000 feet. (No. 17.)" (*Benton.*)

15931. PHYSALIS sp. **Ground cherr**

From Bortschka, Caucasus, Russia. Received thru Mr. Frank Benton, Octobe 24, 1905.

"Found growing wild on the south side of Tschoroch River some miles abov Bortschka, southwestern Caucasus. Elevation about 2,000 feet. Fruit not edibl but quite ornamental, being bright crimson in color, with large crimson seed pod while leaves of plant are still green. (No. 18.)" (*Benton.*)

15932. ACER CIRCINATUM. **Mapl**

From Clearbrook, Wash. Received thru Mr. George Gibbs, October 21, 1905.

15933 to 15940.

From Shanghai, China. Received thru Rev. J. M. W. Farnham, of the Chin Tract Society, October 26, 1905.

15933. LILIUM sp.
15934. (Undetermined.)
15935. AMYGDALUS PERSICA.
15936. (Undetermined.)
15937. CUCURBITA sp.
15938. (Undetermined.)
15939. (Undetermined.)
15940. (Undetermined.)

15941. COLOCASIA ANTIQUORUM ESCULENTUM. **Tar**

From Gotha, Fla. Presented by Mr. H. Nehrling. Received October 26, 1905

Wild taro, erroneously called "Tanyah."

15942 and 15943. LILIUM LONGIFLORUM hyb. **Lily**

From Bellingham, Wash. Received thru Mr. John W. Macrae Smith, Octobe 11, 1905.

15942. LILIUM LONGIFLORUM EXIMIUM GIGANTEUM.

Grown in one year from S. P. I. No. 11591.

15943. LILIUM LONGIFLORUM MULTIFLORUM.

Grown in one year from S. P. I. No. 11794.

15944. LILIUM CANDIDUM. **Lily**

From Olympia, Wash. Received thru Mr. B. F. Denton, September 14, 1905.

15945 and 15946. CYNARA SCOLYMUS. **Artichoke**

From Paris, France. Received thru Vilmorin-Andrieux & Co., October 27, 1905

15945. *Large Flat Brittany.*
15946. *Large Globe*, or *Paris.*

15947 to 15954.

From Hamel, West Australia. Received thru Mr. George F. Berthoud, directo of the State farm, October 26, 1905.

15947. ATRIPLEX HOLOCARPA.
15948. ATRIPLEX LEPTOCARPA.
15949. ANDROPOGON SERICEUS.
15950. ASTREBLA TRITICOIDES.
15951. MICROLAENA STIPOIDES.
15952. DANTHONIA SEMIANNU LARIS.
15953. CLIANTHUS DAMPIERII.
15954. SWAINSONA MACCULLO CHIA.

15955. Elymus canadensis. **Wild rye.**

From Manistee, Mich. Received thru Mr. Stephen Cahill, October 26, 1905.

15956 to 16128. Bromus spp. **Brome-grass.**

From Cambridge, England. Presented by Prof. Marshall Ward, of the Botanic Gardens. Received October 28, 1905.

Sample packets of the following varieties of Bromus gathered from various parts f the world:

15956. Bromus sp., Switzerland, 1902. (186)
15957. Bromus sp., St. Petersburg, 1903. (229)
15958. Bromus sp., St. Owens Bay, Jersey. (240)
15959. Bromus sp., St. Owens Bay, Jersey, 1903. (241)
15960. Bromus adoensis, Kew, 1902. (9)
15961. Bromus alopecurus, Lisbon, 1903. (216)
15962. Bromus altissimus, H. & S., 1903. (230)
15963. Bromus andinus, Stockholm, 1904. (252)
15964. Bromus angustifolius, Berlin, 1902. (10)
15965. Bromus angustifolius, Heidelberg, 1903. (215)
15966. Bromus arduennensis, H. & S., 1902. (11)
15967. Bromus arduennensis, Paris, 1902. (12)
15968. Bromus arduennensis, Schroeter, 1903. (13)
15969. Bromus arduennensis, Brussels, 1902. (184)
15970. Bromus arduennensis villosus, Brussels, 1902. (185)
15971. Bromus arenarius, Sydney, 1902. (210)
15972. Bromus arvensis, Sutton, 1901. (128)
15973. Bromus asper, Coe Fen., Cambridge, 1901, A. H. (1)
15974. Bromus biebersteinii, Schroeter, 1902. (14)
15975. Bromus brachystachys, Upsala, 1902. (16)
15976. Bromus breviaristatus, Rocky Mountains, 1902. (15)
15977. Bromus breviaristatus, Kew, 1902. (150)
15978. Bromus brizaeformis, Sutton, 1901. (129)
15979. Bromus canadensis, Hamburg, 1902. (28)
15980. Bromus canadensis, Glasnevin, 1902. (29)
15981. Bromus canadensis, St. Petersburg, 1902. (30)
15982. Bromus canadensis, Sutton, 1901. (130)
15983. Bromus canadensis, Naples, 1904. (247)
15984. Bromus carinatus, Kew, 1902. (151)
15985. Bromus ciliatus, Cracow, 1902. (19)
15986. Bromus ciliatus, Schroeter, 1902. (21)
15987. Bromus ciliatus, Kew, 1902. (22)
15988. Bromus ciliatus, H. & S., 1902. (23)
15989. Bromus ciliatus, Paris, 1902. (25)
15990. Bromus ciliatus, Vienna, 1902. (26)
15991. Bromus ciliatus, B. G. C., 1901. (170)
15992. Bromus ciliatus, B. G. C., 1901. (171)
15993. Bromus ciliatus, J. Fletcher, 1902. (187)

15956 to 16128—Continued.

15994. Bromus ciliatus (glabrous var.), Bonn, 1902. (20)
15995. Bromus commutatus, Schroeter, 1902. (33)
15996. Bromus commutatus, Madingley, 1903, A. H. (239)
15997. Bromus condensatus, Hack., Schroeter, 1902. (34)
15998. Bromus confertus, Glasnevin, 1902. (35)
15999. Bromus congestus, Glasnevin, 1902. (36)
16000. Bromus crinitus, St. Petersburg, 1901. (152)
16001. Bromus danthoniae, St. Petersburg, 1902. (38)
16002. Bromus diandrus, Glasnevin, 1902. (37)
16003. Bromus erectus, Schroeter, 1902. (40)
16004. Bromus erectus laxus, Strassburg, 1903. (218)
16005. Bromus erectus transylvanicus, Hack., Stockholm, 1902. (118)
16006. Bromus erectus villosus (?), Cherryhinton, 1903, A. H. (214)
16007. Bromus fibrosus, Hack., Schroeter, 1902. (41)
16008. Bromus fimbriatus violaceus, H. & S., 1902. (42)
16009. Bromus fimbriatus violaceus, H. & S., 1903. (219)
16010. Bromus giganteus, Cherryhinton, 1901, A. H. (45)
16011. Bromus giganteus triflorus, S. H. Beckham, 1903. (211)
16012. Bromus grossus, H. & S., 1902. (43)
16013. Bromus gussoni, Glasnevin, 1902. (44)
16014. Bromus gussoni, Benary, 1902. (46)
16015. Bromus hookerianus, Vienna, 1902. (48)
16016. Bromus hordeaceus, St. Petersburg, 1902. (50)
16017. Bromus hordeaceus glabrescens, St. Petersburg, 1902. (49)
16018. Bromus inermis, Schroeter, 1902. (32)
16019. Bromus inermis, Sutton, 1901. (137)
16020. Bromus inermis, B. G. C., 1901. (176)
16021. Bromus inermis (awned var.), St. Petersburg, 1902. (51)
16022. Bromus inermis (viviparous form), Shroeter, 1902. (52)
16023. Bromus intermedius, B. G. C., 1901. (53)
16024. Bromus interruptus, Sutton, 1901. (136)
16025. Bromus japonicus, St. Petersburg, 1902. (54)
16026. Bromus japonicus, Tokyo, 1903. (236)
16027. Bromus kalmii, Paris, 1902. (55)
16028. Bromus kalmii, Kew, 1901. (58)
16029. Bromus krausei, St. Petersburg, 1902. (59)
16030. Bromus krausei, Oxford, 1903. (234)
16031. Bromus laevipes, St. Petersburg, 1902. (67)
16032. Bromus laevipes, Hamburg, 1902. (220)
16033. Bromus laxus, Glasnevin, 1902. (65)
16034. Bromus laxus, Sutton, 1902. (168)
16035. Bromus laxus, Vienna, 1902. (191)
16036. Bromus longiflorus, Paris, 1902. (61)
16037. Bromus longiflorus, Glasnevin, 1902. (62)

15956 to 16128—Continued.

16038. Bromus longiflorus, Upsala, 1902. (63)

16039. Bromus macranthus, Naples, 67, 1904. (253)

16040. Bromus macrostachys, Sutton, 1901. (140)

16041. Bromus macrostachys, Coimbra, 1901. (173)

16042. Bromus macrostachys lanuginosus, Palermo, 1902. (190)

16043. Bromus madritensis, Mrs. Gregory, 1904.

16044. Bromus madritensis, Old Walls, Carrick on Luir, Tipperary, 1902. (242)

16045. Bromus madritensis, Sutton, 1901. (139)

16046. Bromus madritensis delilei, B. G. C., 1901. (100)

16047. Bromus marginatus, St. Petersburg, 1902. (75)

16048. Bromus marginatus, U. S. Dept. Agr., 1902. (202)

16049. Bromus maximus gussoni, Palermo, 1903. (233)

16050. Bromus mollis, Sutton, 1901. (138)

16051. Bromus mollis (deformed fls.), Grumpington Road, August 27, 1902, A. H. (235)

16052. Bromus mollis glabratus, Hayle, Cornwall, 1902. (212)

16053. Bromus mollis lloydianus, Lizard, 1902. (206)

16054. Bromus mollis thominii, B. G. C., 1902. (169)

16055. Bromus multiflorus, Schroeter, 1902. (72)

16056. Bromus parviflorus, Schroeter, 1902. (79)

16057. Bromus patulus, Benary, 1902, (87)

16058. Bromus patulus, Hills Avenue, 1902, A. H. (204)

16059. Bromus patulus nanus, Benary, 1902. (90)

16060. Bromus pendulus, Lyons, 1902. (96)

16061. Bromus pitensis, St. Petersburg, 1902. (95)

16062. Bromus pitensis, Quito, 1903. (232)

16063. Bromus porteri frondans (?), U. S. Dept. Agr., 1902. (198)

16064. Bromus pubescens, Berlin, 1902. (86)

16065. Bromus pumpellianus, Saunders, 1902. (97)

16066. Bromus pumpellianus, Wawanesa, 1902. (192)

16067. Bromus pungens (33.01), B. G. C., 1901. (162)

16068. Bromus pungens ciliatus (?), B. G. C. (37), 1901. (160)

16069. Bromus purgans, Glasnevin, 1902. (81)

16070. Bromus purgans, Hamburg, 1902. (82)

16071. Bromus purgans, Kew, 1902. (83)

16072. Bromus purgans, Lemberg, 1902. (85)

16073. Bromus purgans (41), B. G. C., 1901. (164)

16074. Bromus purgans, B. G. C., 1901. (175)

16075. Bromus purpurascens, Hamburg, 1902. (93)

16076. Bromus purpurascens, Glasnevin, 1902. (94)

16077. Bromus racemosus, near Madingley Chalk Pit, A. H., 1902. (213)

16078. Bromus racemosus, Hamburg. (221)

16079. Bromus racemosus, Kew, 1903. (222)

16080. Bromus racemosus, Breslau, 1903. (223)

15956 to 16128—Continued.

16081. Bromus racemosus, Lyon, 1903. (224)
16082. Bromus racemosus, Babraham, 1903, R. I. Lynch. (237)
16083. Bromus racemosus, Madingley, 1903, A. H. (238)
16084. Bromus racemosus, Madingley, June 28, 1903, A. H. (243)
16085. Bromus richardsoni, U. S. Dept. Agr., 1902. (200)
16086. Bromus rigidus, Kew, 1901. (69)
16087. Bromus rubens, Montpelier, 1902. (101)
16088. Bromus rubens, U. S. Dept. Agr., 1902. (203)
16089. Bromus schraderi, Correvon, 1902. (113)
16090. Bromus schraderi, Upsala, 1902. (114)
16091. Bromus secalinus, Sutton, 1901. (146)
16092. Bromus secalinus, U. S. Dept. Agr., 1902. (194)
16093. Bromus secalinus multiflorus, Upsala, 1902. (116)
16094. Bromus segetum, U. S. Dept. Agr., 1902. (115)
16095. Bromus squarrosus, St. Petersburg, 1902. (78)
16096. Bromus squarrosus, Glasnevin, 1902. (102)
16097. Bromus squarrosus, near *B. rubens*, Roven, 1902. (103)
16098. Bromus squarrosus, Chelsea, 1902. (104)
16099. Bromus squarrosus, Correvon, 1902. (105)
16100. Bromus squarrosus, Schroeter, 1902. (106)
16101. Bromus squarrosus, Paris, 1902. (107)
16102. Bromus squarrosus villosus, Schroeter, 1902. (112)
16103. Bromus squarrosus wolgensis, St. Petersburg. 1902. (110)
16104. Bromus stenophyllus, Glasnevin, 1903. (225)
16105. Bromus sterilis, Sutton, 1901. (145)
16106. Bromus tacna, Paris, 1902. (120)
16107. Bromus tacna, Kew, 1901. (158)
16108. Bromus tacna, Warsaw. (246)
16109. Bromus tectorum, Sutton, 1901. (147)
16110. Bromus tectorum, U. S. Dept. Agr., 1902. (197)
16111. Bromus trinii, Kew, 1905.
16112. Bromus unioloides, Stockholm, 1902. (121)
16113. Bromus unioloides, Schroeter, 1902. (122)
16114. Bromus unioloides, Heidelberg, 1902. (123)
16115. Bromus unioloides, Sutton, 1901. (144)
16116. Bromus unioloides, Sutton, 1901. (148)
16117. Bromus unioloides, B. G. C., 1901. (156)
16118. Bromus unioloides, B. G. C., 1901. (161)
16119. Bromus unioloides, Palermo, 1902. (193)
16120. Bromus unioloides, Upsala, 1902. (207)
16121. Bromus unioloides, Penzance, 1902, A. H. (208)
16122. Bromus unioloides, Quito, 1903. (231)
16123. Bromus unioloides willdenowii, U. S. Dept. Agr., 1902. (196)
16124. Bromus valdivianus, H. & S., 1902. (126)

15956 to 16128—Continued.

16125. BROMUS VARIEGATUS, Vienna, 1902. (125)

16126. BROMUS VESTITUS, Griesswald, 1903. (228)

16127. BROMUS VIRENS, Benary, 1902. (124)

16128. BROMUS WILLDENOWII Kth., U. S. Dept. Agr., 1902. (195)

16129. PHASEOLUS MAX. **Mung bean.**

From New Orleans, La. Received thru Mr. R. E. Blouin, assistant director, Louisiana Sugar Experiment Station, Audubon Park, November 8, 1905.

16130. PISUM ARVENSE. **Canada field pea.**

From Chicago, Ill. Received thru A. Dickinson & Co., November 8, 1905.

16131. GARCINIA MANGOSTANA. **Mangosteen.**

From Heneratgoda, Ceylon. Received thru J. P. William & Bros., November 10, 1905.

"For experiments in grafting on a more resistant stock." (*Fairchild.*)

16132. (Undetermined.) **Aroid.**

From greenhouses of Public Buildings and Grounds, Washington, D. C. Received in June, 1904. Numbered November 10, 1905.

16133. PERSEA INDICA.

From Funchal, Madeira. Presented by Mr. J. B. Blandy. Received November 9, 1905.

"A species related to the avocado of commerce; for breeding purposes and as a stock." (*Fairchild.*)

16134. (Undetermined.) **"Catispa."**

From Guadalajara, Mexico. Received thru Mr. A. W. Geist, November 10, 1905.

"A quick-growing hardwood tree used for live posts for wire fences." (*Geist.*)

16135. MELILOTUS ALBA. **Sweet clover.**

From Augusta, Ga. Received thru the N. L. Willet Drug Company, November 8, 1905.

16136. MEDICAGO SATIVA. **Alfalfa.**

From Billings, Mont. Received thru Mr. I. D. O'Donnell, October 31, 1905.

16137. LATHYRUS SILURUS.

From Salonica, Turkey. Received thru Mr. J. Henry House, October 30, 1905.

"Extensively used as food for cattle. When burned like coffee it is said to make very good cereal coffee—better than barley." (*House.*)

16138. MEDICAGO LUPULINA. **Black medick, or yellow trefoil.**

From New York, N. Y. Received thru J. M. Thorburn & Co., October 30, 1905.

16139. XANTHOSOMA sp. **Yautia.**

From Tepatitlan, Jalisco, Mexico. Received thru Mr. W. E. Safford, from Mr. C. V. Mead, October 31, 1905.

"This yautia apparently belongs to a type distinct from the West Indian forms; the petioles are purplish but the rhizome, tho of two seasons' growth, shows no indications of having produced tubers. This plant is prized by the natives, who sometimes call it "Papa de Colomo." The water in which the rhizomes are boiled should be changed several times." (*Barrett.*)

16140. SWAINSONA MACCULLOCHIANA.

From Sydney, New South Wales. Presented by Mr. J. H. Maiden, director of the Botanic Gardens. Received October 30, 1905.

"This is one of the most horticulturally valuable of all Swainsonas." (*Maiden.*)

16141 to 16159.

Presented by Dr. J. N. Rose, of the United States National Museum, having been collected by him during the summer of 1905, while in Mexico. Received October 30, 1905. The numbers in parentheses are those of Doctor Rose.

16141. AMARYLLIDACEAE.

From 'Pedregal," near Tlalpam, Valley of Mexico. (1013/05.)

16142. HYMENOCALLIS sp.

From limestone hillsides, Tula, Hidalgo. (1036/05.)

16143. ANTHERICUM sp.

From limestone hillsides, Tula, Hidalgo. (1037/05.)

16144. (Undetermined.)

From limestone hillsides, Tula, Hidalgo. (1038/05.)

16145. (Undetermined.)

From limestone hillsides, Tula, Hidalgo. (1039/05.)

16146. (Undetermined.)

From limestone hillsides, Tula, Hidalgo. (1040/05.)

16147. HYMENOCALLIS sp.

From limestone hillsides, Yautepec, Morelos. (1066/05.)

16148. AMARYLLIDACEAE.

In barranca of Rio Aqueduct to near Santa Fe. D. F. (1087/05.)

16149. SPREKELIA sp.

From mountains near Pachuca. (1108/05.)

16150. ZEPHYRANTHES sp.

From mountains near Pachuca. (1109/05.)

16151. MILLA BIFLORA.

From limestone hills near Ixmiquilpam. (1161/05.)

16152. (Undetermined.)

From limestone hillside near Ixmiquilpam. (1162/05.)

16153. (Undetermined.)

From stony hillsides near San Juan del Rio, Quer. (1214/05.)

16154. ECHEANDIA sp.

From stony hillside near San Juan del Rio, Quer. (1216/05.)

16155. (Undetermined.)

From between Cadereyta and Visaron. (1264/05.)

16156. (Undetermined.)

From between Cadereyta and Visaron. (1270/05.)

16157. (Undetermined.)

From hills near El Riego. (1312/05.)

16158. TALINUM sp.

From hills near El Riego. (1317/05.)

16159. AGAVE sp.

From near Cuernavaca, Morelos. (1350/05.)

16160. POLYPTERIS TEXANA.

From Kosse, Tex. Collected by Mr. A. J. Pieters in October, 1905.

Very brilliant rose-colored flowers.

16161. ARACHIS HYPOGAEA. **Peanut.**

From Paris, France. Received thru Vilmorin-Andrieux & Co., October 28, 1905.

16162 to 16164. ARACHIS HYPOGAEA. **Peanut.**

From St. Louis, Mo. Secured by Mr. M. A. Carleton at the Louisiana Purchase Exposition, 1904.

16162. *Nápoli.* From Italy.

16163. *Salerno.* From Italy.

16164. (Unnamed sample from Argentina.)

16165. ZIZANIA AQUATICA. **Wild rice.**

From Port Hope, Canada. Received thru Mr. Charles Gilchrist, November 2, 1905.

16166 to 16168. VIGNA SINENSIS. **Cowpea.**

From St. Louis, Mo. Obtained by Mr. M. A. Carleton in the summer of 1904, at the Louisiana Purchase Exposition.

16166. *Black-eyed.* Labeled *Cosenza.*

Probably from Italy.

16167. *Black-eyed.*

From Reggio Calabria. From the Italian exhibit.

16168. Same as 16167, but labeled *Caserta.*

16169 and 16170. PERSEA spp.

From Monte, Grand Canary. Received thru Mr. Alaricus Delmard, Hotel Santa Brigida, November 2, 1905.

16169. PERSEA INDICA.

16170. PERSEA GRATISSIMA. **Avocado.**

16171 to 16174. BROMUS INERMIS. **Smooth brome-grass.**

From Dwight, Nebr. Received thru Mr. J. P. Dunlap, November 1, 1905.

16171. *Yellow.*

"Best of all the varieties." (*Dunlap.*)

16172. *Hansen's.*

"Much like the yellow, but heads show less pink color when ripening and blades show more purple when dying. Field generally shows less yellow color; nearly as tall as yellow, but less stout in sod. Originally from South Dakota Experiment Station." (*Dunlap.*)

16173. *Colorado.*

"Dark purplish heads; nearly as dark as the darkest kinds, but fading as the heads ripen. Blades nearly as light as those of the *Yellow.* Not so large a grower as the *Yellow* or *Hansen.* Has been experimented with at the Colorado Experiment Station. From Keen Brothers, Pueblo, Colo." (*Dunlap.*)

16174. *Large Dark.*

"Very dark-colored heads when ripening, turning to a reddish brown. Barely equals other kinds in amount of feed; quality not quite so good. On hard land does not stand as well as the others. From R. Rabler, Leigh, Nebr." (*Dunlap.*)

16175 to 16188. IPOMOEA BATATAS. **Sweet potato.**

From the Arlington Farm of the United States Department of Agriculture. Received November 1, 1905.

Fourteen of the best varieties, selected by Mr. W. R. Beattie.

16175. *Florida.*
16176. *McCoy.*
16177. *Hamburg.*
16178. *White Yam.*
16179. *Miles Yam.*
16180. *Early General Grant.*
16181. *Big Stem Jersey.*
16182. *Red Nansemond.*
16183. *Red Jersey.*
16184. *Bermuda Red.*
16185. *Van Nest Red.*
16186. *Early Red Carolina.*
16187. *Bronze Spanish.*
16188. *Southern Queen.*

16189. ORYZA GLUTINOSA. **Glutinous rice.**

From Kiangsu Province, China. Presented by Dr. S. P. Barchet, of Shanghai, China. Received November 4, 1905.

"Doctor Barchet states that the glutinous rice of China brings a higher price and has a better flavor than ordinary rice. He personally prefers it to the latter and advises a mixture of the glutinous with the ordinary rice, claiming that it adds distinctly to the flavor of the dish. This is not the red rice which is considered by our planters as a weed, but is a distinct variety." (*Fairchild.*)

16190. ZEA MAYS. **Corn.**

From Leman, Caucasus, Russia. Received thru Mr. Frank Benton, of the Bureau of Entomology, November 2, 1905.

16191 to 16193.

From the Bulgarian exhibit at the Louisiana Purchase Exposition, 1904. Received November 7, 1905.

16191. VICIA VILLOSA. **Hairy vetch.**
16192. VICIA sp. **Vetch.**
16193. BRASSICA NAPUS. **Rape.**

16194. CURCUMA AMADA. **Mango ginger.**

From Madras, India. Received thru G. Rajah Gopal Naidu, agricultural inspector, June 26, 1903. Numbered November 10, 1905.

16195. ZINGIBER sp.

(Origin in doubt.) Received in November, 1905.

16196. CURCUMA LONGA. **Turmeric.**

From Mayaguez, P. R. Presented by Mr. H. C. Henricksen, horticulturist of the Agricultural Experiment Station. Received November 7, 1905.

"This plant was introduced from the Orient many years ago and has escaped from cultivation and become a troublesome weed in pastures in the western portion of Porto Rico. It flowers freely, but spreads only from the roots. It is one of the two or three commercial turmerics, but has no sale in this country because the special process by which it is prepared in the Orient is unknown here." (*Barrett.*)

16197 to 16207.

From Dr. J. N. Rose, of the United States National Museum, Washington, D. C. Received November 7, 1905.

16197. YUCCA sp.

Lower California, 1905. (E. W. Nelson No. 7129.)

16197 to 16207—Continued.

16198. AGAVE sp.

Lower California, 1905. (E. W. Nelson No. 7151.)

16199. (Undetermined.)

Lower California, 1905. (E. W. Nelson No. 7157.)

16200. IBERVILLEA SONORAE.

Lower California, 1905. (E. W. Nelson No. 7182.)

A large cucurbit vine; lives in dry regions and forms a large, bulbous root.

16201. IBERVILLEA sp.

Lower California, 1905. (E. W. Nelson No. 7182.)

16202. (Undetermined.)

Laredo, Tex., June 27, 1905. (J. N. Rose No. 1013.,

16203. (Undetermined.)

"Bulb" from Haciendo Ciervo, Mexico, 1905. (J. N. Rose No. 1266/05.)

16204. ZEPHYRANTHES sp.

From mountains near Pachuca, Mexico, 1905. (J. N. Rose 1109/05.)

16205. DASYLIRION sp. nov.

Limestone hills west of El Riego, Tehuacan, Puebla, Mexico, 1905. (J. N. Rose No. 10009.)

16206. AGAVE sp.

El Riego, Tehuacan, Puebla, Mexico, 1905. (J. N. Rose No. 10006.)

16207. AMPHYPTERYGIUM sp.

Near Tomellin, Oaxaca, Mexico, 1905. (J. N. Rose No. 10096.)

16208. DAVIDIA INVOLUCRATA. **Davidia.**

From London, England. Received thru J. Veitch & Sons, November 2, 1905.

In the whole vegetable kingdom there is not a more striking object than a tree of Davidia when covered with its pure white bracts, which make it conspicuous at a great distance. It is a handsome tree, growing to a height of 60 to 70 feet, with foliage much resembling that of our common linden or basswood. When in full flower it is said to be a marvelous sight, owing to the alternate white and green caused by the large bracts intermingling with the leaves. The flowers themselves are polygamo-diœcious, all borne in heads inside a pair of large, white bracts about 3 inches long, with conspicuous red-anthered stamens and a long, bottle-shaped gynœcium. Botanically, the plant is allied to the dogwoods.

Growing at an elevation of 6,000 to 7,000 feet in central China, where the minimum temperature is about 5° F., there ought to be little doubt as to its hardiness in the greater part of the United States. Trees set out in France have survived the winters at Paris, while others in England have withstood 15 degrees of frost unprotected. Until well established, however, some protection in very severe weather is recommended. New plants are readily obtained by cuttings or by layering, and should be planted in a rich soil, with some protection from too much sunshine.

16209. MEDICAGO SATIVA. **Alfalfa.**

From Chicago, Ill. Received thru the A. Dickinson Company, November 8, 1905.

16210 and 16211. PHASEOLUS RADIATUS. **Mung bean.**

From Chillicothe, Tex. Received thru Mr. A. B. Conner, November 7, 1905.

16210. Grown from S. P. I. No. 13394.

16211. Grown from S. P. I. No. 8540.

16212. (Undetermined.)

From Newcastle, New South Wales. Received thru Dr. Frederic W. Goding, United States consul, November 8, 1905.

16213. MEDICAGO MACULATA. **Bur clover.**

From Abbeville, S. C. Received thru Mr. Arthur Parker, November 11, 1905.

16214. MUSA TEXTILIS. **Manila hemp.**

From Manila, P. I. Received thru Mr. W. S. Lyon, Insular Bureau of Agriculture, November 13, 1905.

16215 to 16222. ERODIUM spp.

From Geneva, Switzerland. Received thru Mr. H. Correvon, November 13, 1905.

16215. ERODIUM HYMENODES.

16216. ERODIUM CHELIDONIFOLIUM.

16217. ERODIUM PELARGONIFOLIUM.

16218. ERODIUM DAUCOIDES.

16219. ERODIUM GLANDULOSUM.

16220. ERODIUM MACRADENUM.

16221. ERODIUM MANESCAVI.

16222. ERODIUM MACROPHYLLUM.

16223. CARUM GAIRDNERI.

From Pendleton, Oreg. Received thru Mr. W. H. Bleakney, November, 1905.

"This plant was formerly a staple article of food among the Umatilla and other Indian tribes of the Pacific Northwest. The roots may be eaten either raw or cooked. They have a delicious flavor." (*Coville.*) (See also No. 12932.)

16224. BLIGHIA SAPIDA. **Akee.**

From Kingston, Jamaica. Received thru Mr. G. N. Collins, November, 1905.

"Unless fully matured, the white fleshy arillus of this excellent fruit is regarded as poisonous by the natives of Jamaica." (*Collins.*)

16225 and 16226. XANTHOSOMA spp. **Yautia.**

From Floral Park, Long Island, N. Y. Received thru Mr. John Lewis Childs, November 17, 1905.

16225. XANTHOSOMA SAGITTIFOLIUM.

16226. XANTHOSOMA sp.

16227. EUCALYPTUS GONIOCALYX. **Eucalypt.**

From Guadalajara, Mexico. Received thru Mr. Federico Chisolm, November 17, 1905.

16228. POA PRATENSIS. **Kentucky bluegrass.**

From Winchester, Ky. Received thru Mr. D. S. Gay, November 17, 1905.

16229. VIGNA SINENSIS. **Cowpea.**

From Bristol, Conn. Received thru Mr. Herman Ockels, November 10, 1905.

16230. PASPALUM DILATATUM. **Large water grass.**

From Biloxi, Miss. Received thru Mr. S. M. Tracy, November 18, 1905.

16231. ARALIA RACEMOSA. **Spikenard.**

From North Clarendon, Vt. Received thru Mr. James Barrett, November 21, 1905.

Roots and berries of the wild spikenard are used in the preparation of a remedy for catarrhal affections. For use in breeding with *Aralia cordata*, the Japanese "udo."

16232. TECOMA CAPENSIS (?).

From Lourenço Marquez, Portuguese East Africa. Received thru Hon. W. Stanley Hollis, United States consul, November 21, 1905.

"Seeds of a native African shrub that is much used in making hedges. Might be advantageously used in the warmer parts of the United States." (*Hollis.*)

16233 to 16236. ARACHIS HYPOGAEA. **Peanut.**

From Sydney, New South Wales. Received thru Mr. Walter S. Campbell, director of agriculture, Department of Mines and Agriculture, November 22, 1905.

16233. *Mammoth Bush.*

16234. *Improved Large.*

16235. *Cluster.*

16236. *Small.*

16237 to 16243. NEPHELIUM LITCHI. **Litchi.**

From Canton, China. Secured thru Dr. John M. Swan, of the Medical Missionary Hospital, and forwarded by the Yokohama Nursery Company, Yokohama, Japan. Received at Berkeley, Cal., October, 1905.

"This fruit tree, represented by many varieties, is worthy of thoro trial in Porto Rico, Hawaii, southern California, and Florida. It is one of the most delicious fruits in the world." (*Fairchild.*)

16237. (Without labels.)

16238. (No. 1.)

16239. *Hak Ip.*

A favorite early sort, ripening in the fifth month.

16240. *Nue Mai.*

A large-fruited, small-seeded variety extremely sweet. Ripens in the fifth or sixth month.

16241. *Kwai Mai.*

A very popular sort. Ripens at end of fifth month.

16242. (No. 2.)

16243. (No. 3.)

16244. FESTUCA OVINA INGRATA.

From Wenache Mountains, Washington, at an altitude of 6,000 feet. Collected by Mr. J. S. Cotton, of the Department of Agriculture, September, 1904. Received November, 1905.

16245 to 16247.

From New York, N. Y. Received thru Henry Nungesser & Co., November 21, 1905.

16245. ARRHENATHERUM ELATIUS. **Tall meadow oat-grass.**

16246. ONOBRYCHIS ONOBRYCHIS. **Sainfoin.**

16247. HOLCUS LANATUS. **Velvet grass.**

16248 to 16253. SOLANUM TUBEROSUM. **Potato.**

From Portsmouth, Va. Grown under the direction of Mr. W. A. Orton, of the Department of Agriculture, during the summer of 1905, from seed potatoes introduced from Ecuador, July, 1905.

16248. Round white potatoes.

Grown from S. P. I. No. 14973; first type. (P. B. No. 679b.)

16249. Round or elongated red potatoes.

Grown from S. P. I. No. 14973; second type. (P. B. No. 679c.)

16250. Elongated white potatoes.

Grown from S. P. I. No. 14973; third type. (P. B. 679d.)

16251. Round dark-red potatoes.

Grown from S. P. I. No. 14893. (P. B. No. 676.)

16252. Round white potatoes.

Grown from S. P. I. No. 14894. (P. B. No. 677.)

16253. Oval white potatoes.

Grown from S. P. I. No. 14895. (P. B. No. 678.)

16254 to 16275.

From Karlsruhe, Germany. Received thru the Botanic Gardens, November 17, 1905.

16254. Aegilops squarrosa.
16255. Arrhenatherum elatius.
16256. Brachypodium pinnatum.
16257. Eleusine tocussa.
16258. Erodium gruinum.
16259. Erodium stephanianum.
16260. Medicago ciliaris.
16261. Medicago echinus.
16262. Medicago elegans.
16263. Medicago sativa × falcata.
16264. Medicago minima.
16265. Medicago orbicularis.
16266. Medicago radiata.
16267. Medicago scutellata.
16268. Melilotus altissima.
16269. Melilotus italica.
16270. Trigonella coerulea.
16271. Trigonella corniculata.
16272. Triticum rigidum.
16273. Triticum trichophorum.
16274. Vicia cornigera.
16275. Vicia dumetorum.

16276 to 16302.

From Strassburg, Germany. Received thru the Botanic Gardens, November 21, 1905.

16276. Aegilops speltoides.
16277. Avena brevis.
16278. Avena hirsuta.
16279. Avena ludoviciana.
16280. Avena orientalis.
16281. Avena planiculmis.
16282. Avena strigosa.
16283. Bromus erectus.
16284. Erodium gruinum.
16285. Lappago racemosa.
16286. Medicago gerardi.
16287. Medicago terebellum.
16288. Medicago turbinata.
16289. Melilotus alba.
16290. Phaseolus caffer
16291. Pisum jomardi.
16292. Triticum boeoticum.
16293. Triticum boeoticum thaoudar.
16294. Triticum dicoccum.
16295. Triticum giganteum.
16296. Triticum monococcum.
16297. Triticum monococcum hornemanni.
16298. Triticum polonicum.
16299. Triticum rigidum.
16300. Vigna glabra.
16301. Pisum elatius.
16302. Phaseolus multiflorus.

16303 to 16335.

From Kashgar, Chinese Turkestan. Received from Mr. Ellsworth Huntington, Kashgar, Chinese Turkestan, via Baku, Russia, thru the Chinese Amban of Khotan, and Mr. Macartney, British political agent at Kashgar, November 17, 1905.

"Khotan is a large, well-watered oasis, at an elevation of about 4,500 feet, at the foot of the Kuen Lun Mountains. Longitude 80°, latitude 37° N. In general, the climate is typically midcontinental. It may be likened to that of Colorado, tho drier and more extreme." (*Huntington.*)

16303. Vigna sinensis. **Cowpea.**

Lobia. A white bean.

16304. Brassica napus (?). **Turnip.**

Chamgu.

16305. (Undetermined.)

Usun.

16303 to 16335—Continued.

16306. CITRULLUS VULGARIS. **Watermelon.**

Tarbuz.

16307. CORIANDRUM SATIVUM. **Coriander.**

Gesnich.

16308. ALLIUM sp. **Onion.**

Kuda.

16309. FOENICULUM DULCE (?). **Fennel.**

Siadana.

16310. BRASSICA sp. **Mustard.**

Kichi.

16311. SESAMUM INDICUM. **Sesame.**

Kunjut.

16312. BRASSICA OLERACEA (?). **Cabbage.**

Baseh.

16313. ALLIUM CEPA (?). **Onion.**

Piaz.

16314. PANICUM MILIACEUM. **Millet.**

Tarekh.

16315. APIUM GRAVEOLENS. **Celery.**

Chingseh.

16316. AGRIOPHYLLUM GOBICUM. **Sulhir.**

Palak.

16317. MEDICAGO SATIVA. **Alfalfa.**

Beda.

16318. DAUCUS CAROTA. **Carrot.**

Zardek.

16319. CUCUMIS MELO. **Muskmelon.**

Kaghun.

16320. CICER ARIETINUM. **Chick-pea.**

Narkhot.

16321. LINUM USITATISSIMUM. **Flax.**

Zighar. A variety of flax used only for oil.

16322. CUCUMIS SATIVUS. **Cucumber.**

Khonga.

16323. PHASEOLUS RADIATUS. **Mung bean.**

Mash, or *Dal pea.*

16324. CARTHAMUS TINCTORIUS. **Safflower.**

Zarangzeh.

16325. BRASSICA sp. **Mustard.**

Zaghun. Extensively cultivated for oil.

16326. PISUM sp. **Pea.**

Puchek.

16327. TRITICUM VULGARE. **Wheat.**

Bugdai.

16303 to 16335—Continued

16328. ORYZA SATIVA. **Rice.**

Shal.

16329. HORDEUM sp. **Barley.**

Arpa.

16330. ZEA MAYS. **Corn.**

Konak.

16331. CUCURBITA sp. **Squash** (?).

Kawa.

16332. LAGENARIA VULGARIS (?). **Gourd.**

Kapak.

16333. CANNABIS SATIVA. **Hemp.**

Bang. Used for smoking.

16334. IRIS ENSATA PABULARIA. **Iris.**

Chigitmak. "A species of iris said to grow in the dry desert sand or almost anywhere if once it gets rain enough to cause it to sprout. It is reported to be a good forage plant, both green and dry. Sheep are very fond of it, and other animals do not object to it." (*Huntington.*)

16335. TRIGONELLA FOENUM-GRAECUM. **Fenugreek.**

Shemshu.

16336 to 16470.

From Pullman, Wash. Received thru Mr. Byron Hunter, assistant agrostologist of the Department of Agriculture, November 14, 1905.

Seeds grown at the Agricultural Experiment Station at Pullman, Wash., together with others collected from various sources.

16336. AGROPYRON sp.

A promising grass.

16337. AGROPYRON DIVERGENS.

Collected in August, 1904, on the Moscow Mountains.

16338. AGROPYRON DIVERGENS.

Collected June 29, 1905, at Wawawai, Wash. (Agros. No. 579.)

16339. AGROPYRON ELMERI.

Collected August 4, 1904, at Wawawai, Wash. (Agrost. No. 675.)

16340. AGROPYRON OCCIDENTALE.

Crop of 1905.

16341. AGROPYRON OCCIDENTALE.

Grown at Harlem, Mont.

16342. AGROPYRON PSEUDO-REPENS.

Crop of 1905.

16343. AGROPYRON SPICATUM.

Crop of 1905.

16344. AGROPYRON TENERUM.

Crop of 1905. (Agrost. No. 211.)

16345. AGROPYRON TENERUM.

Crop of 1904.

16346. AGROPYRON TENERUM.

Crop of 1905. Grown from seed collected at Trinidad, Colo.

16347. TRITICUM VIOLACEUM.

Crop of 1905. (Agrost. No. 210.)

16348. ALOPECURUS CASTELLANUS.

Crop of 1903.

16349. ARRHENATHERUM ELATIUS. **Tall meadow oat-grass.**

Crop of 1905. (Agrost. No. 2191.)

16350. AVENA FLAVESCENS.

Crop of 1905. (Agrost. No. 2192.)

16351. AVENA ORIENTALIS.

Crop of 1905. (Agrost. No. 1157.)

16352. AVENA SATIVA. **Oat.**

Grown in 1905 from Argentine seed.

16336 to 16470—Continued.

16353. Bromus sp.

Crop of 1905. (Agrost. No. 245.)

16354. Bromus carinatus.

Collected at Wawawai, Wash., in 1904.

16355. Bromus carinatus.

Grown in 1905 from seed originally collected at Wawawai, Wash.

16356. Bromus carinatus.

Grown in 1904 at Chehalis, Wash. (Agrost. No. 609.)

16357. Bromus carinatus hookerianus.

Crop of 1905.

16358. Bromus carinatus hookerianus.

16359. Bromus inermis. **Smooth brome-grass.**

16360. Bromus marginatus.

Crop of 1904.

16361. Bromus marginatus.

"*Eight-dollar Grass.*" Grown at Selma, Oreg.

16362. Bromus marginatus.

Grown in 1905 from Portland, Oreg., seed.

16363. Bromus marginatus.

Crop of 1905.

16364. Bromus marginatus elatior.

16365. Bromus marginatus maritimus.

Crop of 1905. (Agrost. No. 2261.)

16366. Bromus marginatus pumpellianus.

Crop of 1905.

16367. Bromus polyanthus.

Gathered at Portland, Oreg., in 1904. (Agrost. No. 614.)

16368. Bromus polyanthus.

Crop of 1905. (Agrost. No. 319.)

16369. Bromus polyanthus paniculatus.

16370. Bromus sitchensis.

Grown in 1904 from seed gathered at Puyallup, Wash. (Agrost. No. 600.)

16371. Dactylis glomerata. **Orchard grass.**

Purchased from the C. H. Lilly Company, Seattle, Wash.

16372. Dactylis glomerata. **Orchard grass.**

Crop of 1905.

16373. Deschampsia caespitosa.

Crop of 1904.

16374. Elymus canadensis. **Wild rye.**

16375. Elymus virginicus submuticus.

Crop of 1902. (Agrost. No. 328.)

16376. Elymus virginicus submuticus.

Grown in 1905 from S. P. I. No. 16375.

16377. Festuca arundinacea.

16378. Festuca elatior. **Tall fescue.**

Grown from Kansas seed.

16379. Festuca hyb.

A hybrid from Mr. A. B. Leckenby, Union, Oreg.

16380. Festuca pratensis. **Meadow fescue.**

16381. Festuca reflexa.

16382. Lathyrus azureus.

Grown in 1905 from S. P. I. No. 11195.

16383. Lathyrus coccineus.

Grown in 1905 from S. P. I. No. 11196.

16384. Lathyrus ochrus.

Crop of 1905.

16336 to 16470—Continued.

16385. Lathyrus sativus. **Bitter vetch.**

Grown in 1905 from S. P. I. No. 11197.

16386. Lathyrus sativus. **Bitter vetch.**

Grown in 1905 from S. P. I. No. 11198.

16387. Lathyrus sativus. **Bitter vetch.**

Grown in 1905 from S. P. I. No. 11199.

16388. Lathyrus tingitanus. **Tangier scarlet pea.**

Grown in 1905 from S. P. I. No. 11220.

16389. Lathyrus tingitanus. **Tangier scarlet pea.**

Grown in 1905 from Agrost. No. 1548.

16390. Lolium bonariensis.

Grown in 1905 from Agrost. No. 2321.

16391. Lolium perenne. **Perennial rye-grass.**

From E. J. Bowen, San Francisco, Cal.

16392. Lolium perenne. **Perennial rye-grass.**

Grown in 1905 from seed secured in Holland.

16393. Lolium perenne. **Perennial rye-grass.**

Grown in 1905 from Agrost. No. 1981.

16394. Lolium perenne. **Perennial rye-grass.**

Grown in 1905 from Agrost. No. 5349. From Argentine seed.

16395. Lotus americanus. **Dakota vetch.**

From Cusick, Wash.

16396. Lotus americanus. **Dakota vetch.**

From Wenatchee, Wash.

16397. Lotus corniculatus. **Bird's-foot trefoil.**

Grown in 1905 from S. P. I. No. 11204.

16398. Lotus tetragonolobus. **Winged pea.**

Grown in 1905 from S. P. I. No. 10398.

16399. Medicago media. **Sand lucern.**

Crop of 1904.

16400. Medicago media. **Sand lucern.**

Crop of 1905.

16401. Medicago sativa. **Alfalfa.**

Grown by Mr. E. W. Downen, Pullman, Wash., in 1904.

16402. Medicago sativa. **Alfalfa.**

Turkestan alfalfa. Grown at Walla Walla, Wash., in 1904, from S. P. I. No. 991.

16403. Medicago sativa. **Alfalfa.**

Turkestan alfalfa. Grown in 1905 at Pullman, Wash., from seed obtained from Mr. M. Evans.

16404. Melilotus indicus.

Grown from Agrost. No. 1684.

16405. Melilotus macrostachys.

Grown from Agrost. No. 1553.

11406. Melilotus sulcata.

Grown from Agrost. No. 1161.

16407. Melica californica.

Grown in 1905 from Agrost. No. 1925.

16336 to 16470—Continued.

16408. PANICUM sp. **Bird seed.**
Crop of 1905.

16409. PANICUM sp. **Hungarian millet.**
Grown in 1905 from Agrost. No. 2355.

16410. PANICUM CRUS-GALLI.
Grown from Agrost. No. 1682.

16411. PANICUM CRUS-GALLI.
Crop of 1905.

16412. PANICUM MILIACEUM. **Broom-corn millet.**
Grown from Agrost. No. 2620.

16413. PANICUM MILIACEUM. **Broom-corn millet.**
Grown from Agrost. No. 2621.

16414. PANICUM MILIACEUM. **Broom-corn millet.**
Mixt yellow and white broom-corn millet. Grown from Agrost. No. 2625.

16415. PANICUM MILIACEUM. **Broom-corn millet.**
Grown from Agrost. No. 2626.

16416. PANICUM MILIACEUM. **Broom-corn millet.**
White. Grown from Agrost. No. 2627.

16417. PANICUM MILIACEUM. **Broom-corn millet.**
Grown from Agrost. No. 2628.

16418. PANICUM MILIACEUM. **Broom-corn millet.**
White seed; late variety. Grown from Agrost. No. 2629.

16419. PANICUM MILIACEUM. **Broom-corn millet.**
Grown in 1905 from seed obtained at Cusick, Wash.

16420. PANICUM MILIACEUM. **Broom-corn millet.**
White. Grown from seed obtained in Germany.

16421. PANICUM MILIACEUM. **Broom-corn millet.**
Grown from Austrian seed.

16422. PANICUM MILIACEUM. **Broom-corn millet.**
Austrian seed.

16423. PANICUM MILIACEUM. **Broom-corn millet.**
Grown in 1904 at Usk, Wash.

16424. PENNISETUM SPICATUM. **Pearl millet.**
Grown at Biggenden, Queensland. (Agrost. No. 2110.)

16425. PHALARIS ARUNDINACEA. **Reed canary grass.**
Grown from seed obtained from J. M. Thorburn & Co., New York City, N. Y.

16426 to 16432. PHALARIS CANARIENSIS. **Canary grass.**

16426.
Grown from Agrost. No. 1683.

16427.
Grown from Agrost. No. 2331.

16428.
Grown from Agrost. No. 2332.

16429.
Grown from Agrost. No. 2333.

16430.
Grown from Agrost. No. 2334.

16431.
Grown from Agrost. No. 2335.

16432.
From Genoa, Italy. Obtained at the Louisiana Purchase Exposition in 1904. (Agrost. No. 2361.)

16336 to 16470—Continued.

16433. PHLEUM PRATENSE. **Timothy.**

Early.

16434. PHLEUM PRATENSE. **Timothy.**

Stewart's Mammoth.

16435. PHLEUM PRATENSE. **Timothy.**

Pasture.

16436. PISUM ARVENSE. **Field pea.**

Grown from S. P. I. No. 1486.

16437. PISUM ARVENSE. **Field pea.**

Grown from S. P. I. No. 1487.

16438. PLANTAGO FASTIGIATA.

Grown from seed originally obtained in Arizona.

16439. PLANTAGO FASTIGIATA.

Crop of 1904.

16440. POA TRIFLORA.

Grown at Cusick, Wash.

16441. SPARTINA sp.

Grown at Cusick, Wash.

16442. SPARTINA CYNOSUROIDES.

16443. STIPA TENACISSIMA. **Esparto grass.**

Grown from seed obtained from J. M. Thorburn & Co., New York, N. Y. (Agrost. No. 2216.)

16444. TRIFOLIUM PANNONICUM.

Grown from S. P. I. No. 9817.

16445. TRIFOLIUM PRATENSE. **Red clover.**

Grown in 1904 by Mr. C. R. Widmer, Albany, Oreg.

16446. TRIGONELLA FOENUM-GRAECUM. **Fenugreek.**

Grown from Egyptian seed.

16447. VICIA sp. **Vetch.**

A variety similar to pearl vetch. Grown from Agrost. No. 2452.

16448. VICIA sp. **Vetch.**

Grown from S. P. I. No. 11200.

16449. VICIA sp. **Vetch.**

Grown at Ray, Wash.

16450. VICIA sp. **Vetch.**

Grown from S. P. I. No. 11199.

16451. VICIA sp. **Vetch.**

Grown from Agrost. No. 2454.

16452. VICIA ATROPURPUREA. **Vetch.**

Grown from S. P. I. No. 12135.

16453. VICIA BITHYNICA. **Vetch.**

Grown from S. P. I. No. 11230.

16454. VICIA CRACCA. **Vetch.**

Grown from S. P. I. No. 10283.

16455. VICIA CRACCA. **Vetch.**

Grown from Chinese seed.

16456. VICIA EGYPTICA. **Vetch.**

16336 to 16470—Continued.

16457. VICIA FABA. **Vetch.**

Grown from Agrost. No. 2463.

16458. VICIA FULGENS. **Vetch.**

Grown from S. P. I. No. 11231.

16459. VICIA GIGANTEA. **Vetch.**

Grown in 1904 at Clatskanie, Oreg. (Agrost. No. 613.)

16460. VICIA HIRSUTA(?). **Japan vetch.**

Grown from S. P. I. No. 9237.

16461. VICIA HIRTA. **Vetch.**

16462. VICIA LUTEA. **Vetch.**

Grown from Algerian seed.

16463. VICIA MICRANTHA. **Vetch.**

Grown from Agrost. No. 999.

16464. VICIA NARBONNENSIS. **Vetch.**

Grown from S. P. I. No. 11232.

16465. VICIA SATIVA ALBA. **Pearl vetch.**

16466. VICIA SATIVA. **Common vetch.**

Grown at Corvallis, Oreg.

16467. VICIA SATIVA ALBA. **Pearl vetch.**

Grown from seed from Mr. Henry Gilbrich, New Era, Oreg.

16468. VICIA SICULA. **Vetch.**

Crop of 1904.

16469. VICIA SICULA. **Vetch.**

Grown from Algerian seed.

16470. VICIA VILLOSA. **Hairy vetch.**

Seed from Mr. Elliott.

16471. ANDROPOGON HALEPENSIS. **Johnson grass.**

From St. Louis, Mo. Received thru D. J. Bushnell & Co., November 25, 1905.

16472 and 16473.

From Durban, Natal, South Africa. Received thru the Botanic Gardens, November 25, 1905.

16472. ARACHIS HYPOGAEA. **Peanut.**

16473. VOANDZEIA SUBTERRANEA. **Woandzu.**

16474. LESPEDEZA STRIATA. **Japan clover.**

From Richmond, Va. Received thru T. W. Wood & Son, November 29, 1905.

16475. LESPEDEZA STRIATA. **Japan clover.**

Received from the Office of Grass and Forage Plant Investigations of the Department of Agriculture, November, 1905. (Agrost. No. 1115.)

16476. CUCURBITA sp. **Pumpkin.**

From Pretoria, South Africa. Received thru Prof. J. Burtt Davy, of the Transvaal Department of Agriculture, November 27, 1905.

16477 to 16480. GARCINIA spp.

From Sagua la Grande, Cuba. Received thru J. S. Montero & Bros., December 1, 1905.

16477. GARCINIA COCHINCHINENSIS.

16478. GARCINIA FERREA.

16479. GARCINIA HANBURYI.

16480. GARCINIA INDICA.

16481. IBERVILLEA sp. (?).

From Mexico. Received thru Dr. J. N. Rose, of the United States National Museum, who collected the seed in the summer of 1905.

"A very interesting, attractive vine, which grows in very dry districts. Fruit red." (*Rose.*)

16482. CALYPTROGYNE DULCIS.

From Santiago de las Vegas, Cuba. Received thru Departamento de Botánica, Estación Central Agronómica, November 28, 1905.

16483 to 16485. ARACHIS HYPOGAEA. **Peanut.**

From Cat Island, S. C. Grown by Mr. J. H. Tull, special agent of the Department of Agriculture. Received November 20, 1905.

16483. Grown from S. P. I. No. 4253. From Cairo, Egypt.

16484. Grown from S. P. I. No. 9406. From Sao Paulo, Brazil.

16485. Grown from S. P. I. No. 11140. From Spain.

16486. ARACHIS HYPOGAEA. **Peanut.**

From Japan. Received thru the Botanic Gardens, Durban, Natal, South Africa, December 2, 1905.

16487. DIOSPYROS EBENUM. **Sapote negro.**

From Manila, P. I. Received thru Mr. Thomas L. Lyon, of the Insular Bureau of Agriculture, December 2, 1905.

"Wood reputed good, but variable in color. One of the most attractive of our broad-leaved evergreens. Fruits astringent." (*Lyon.*)

16488. VICIA SATIVA ALBA. **Pearl vetch.**

From New Era, Oreg. Received thru Mr. Henry Gelbrich, December 5, 1905.

16489. MELILOTUS ALBA. **Sweet clover.**

From Birmingham, Ala. Received thru the Amzi Godden Seed Company, December 4, 1905.

16490 to 16494. JUNCUS spp. **Matting rush.**

Collected by Mr. J. H. Tull, special agent of the Department of Agriculture. Received December 5, 1905.

16490. JUNCUS EFFUSUS.

Collected on Cat Island, S. C.

16491. JUNCUS EFFUSUS CONGLOMERATUS.

Collected near Kinston, N. C.

16492. JUNCUS EFFUSUS CONGLOMERATUS.

Collected on Black River road, near Georgetown, S. C.

16493. JUNCUS EFFUSUS CONGLOMERATUS.

Collected on Cat Island, S. C.

16494. JUNCUS EFFUSUS CONGLOMERATUS.

Collected near Newbern, N. C.

16495 to 16505.

From the White House Propagating Gardens, Washington, D. C. Received December 5, 1905.

A collection of ornamentals.

16495. Calathea ornata majestica.

16496. Xanthosoma lindeni.

16497. Calathea pulchella.

16498. Calathea vandenheckei.

16499. Calathea intermedia.

16500. Calathea warscewiczii.

16501. Ischnosiphon hirsuta.

16502. Maranta wallisi.

16503. Maranta amabilis.

16504. Homalomena wallisi.

16505. Calathea (?) sp.

16506. Aralia cordata. **Udo.**

From Waseda, Tokyo, Japan. Received thru J. Ikeda & Co.. December 5, 1905.

16507. Panicum sp.

From Pretoria, South Africa. Received thru Prof. J. Burtt Davy, of the Transvaal Department of Agriculture, December 5, 1905.

16508. Medicago sativa. **Alfalfa.**

From Amasia, Turkey. Received thru Mr. H. Caramanian, November 25, 1905.

16509 to 16540.

From Nancy, France. Received thru Victor Lemoine & Son, December 4, 1905.

16509. Anemone japonica.

16510. Anemone japonica.

16511. Deutzia myriantha.

16512. Deutzia vilmorinae.

16513. Philadelphus lemoinei.

16514 to 16540. Phlox decussata. **Perennial phlox.**

Named varieties.

16541 to 16762. Paeonia spp. **Peony.**

From Chenonceaux (Indre-et-Loire), France. Received thru Monsieur A. Dessert, December 2, 1905.

16541 to 16642. Named varieties of the Chinese herbaceous section.

16643 to 16659. Named varieties of the European herbaceous section.

16660. Paeonila anomala (or Smouthii).

16661. Paeonia tenuifolia.

16662. Paeonia tenuifolia flore pleno.

16663 to 16759. Paeonia moutan. Named double varieties.

16760 to 16762. Paeonia moutan. Named single varieties.

16763 and 16764.

From the Office of Gardens and Grounds, Department of Agriculture. Received December 8, 1905.

16763. Calathea sp.

Rough-pubescent petiole basal; green thruout.

16764. Maranta sp.

Near *Maranta arundinacea*, but with side shoots on culms.

16765 to 16769.

From the White House greenhouse, Public Buildings and Grounds, Washington, D. C. Received December 8, 1905.

16765. Maranta splendida.

16766. Calathea arrecta.

16767. Calathea makoyana.

16768. Calathea roseo-picta.

16769. Calathea undulata.

16770. Zea mays. **Sweet corn.**

From North Clarendon, Vt. Received thru Mr. D. Dana Hewitt, December 11, 1905.

White Malakof. Grown from S. P. I. No. 13256. (Lot "A" selected from No. 16772.)

16771. Medicago denticulata. **Bur clover.**

From San Francisco, Cal. Received thru the Jessup-Wheelan Company, December 11, 1905.

16772. Zea mays. **Sweet corn.**

From North Clarendon, Vt. Received thru Mr. D. Dana Hewitt, December 11, 1905.

White Malakof. Grown from S. P. I. No. 13256.

16773 to 16780.

From St. Louis, Mo. Received thru Mr. Fred Mueller, of the Missouri Botanical Gardens, December 11, 1905.

16773. Alocasia macrorhiza variegata.

From Ceylon.

16774. Alocasia odora.

From East Indies.

16775. Colocasia sp.

From Mexico.

16776. Colocasia antiquorum euchlora.

From India.

16777. Colocasia indica.

16778. Xanthosoma sp.

From Cuba.

16779. Xanthosoma violaceum.

From West Indies.

16780. (Undetermined.)

16781 to 16784. Zea mays. **Sweet corn.**

From North Clarendon, Vt. Received thru Mr. D. Dana Hewitt, December 11, 1905.

White Malakof.

16781. Grown from S. P. I. No. 13357.

16782. Grown from selection "B" of S. P. I. No. 13256.

16783. Grown from selection "G" of S. P. I. No. 13256.

16784. Grown from selection "C" of S. P. I. No. 13256.

16785. Hibiscus sabdariffa. **Roselle.**

From Mayaguez, P. R. Received thru the Porto Rico Experiment Station, December, 1905.

16786. Eucalyptus corymbosa. **Bloodwood.**

From Bowen, North Queensland, Australia. Received thru Mr. William Pettigrew, of the Queensland Acclimatization Society, December 6, 1905.

"One of the numerous species of Australian eucalyptus. A tree of medium size, with persistent flaky bark, often reported as stunted or shrubby in appearance, but frequently attaining a height of 150 feet and a trunk diameter of 3 feet. It is restricted to the warmer and moister coast regions of northeast Australia, and, to judge by its absence in the interior, could hardly be expected to grow in a region subject to frost or extremes of dryness. The tree furnishes a wood that is easily worked when fresh, but exceedingly hard when dry. The presence of kino makes it unsuitable for lumber or fuel, but also serves to make it very durable underground and resistant to white ants; hence it is very valuable for railroad ties, posts, culverts, for paving, and for other uses in underground situations. Fence posts of this material are reported to have lasted for forty years in Australia. The bark yields 28 per cent tannic acid and the leaves about 18 per cent. The creamy white flowers of this tree contain a large amount of nectar and are much visited by bees. The tree is also one of the sources of the kino of commerce." (*McClatchie.*)

16787. GARCINEA SPICATA. **Fukuji tree.**

From Riu Kiu Islands, Japan. Received thru Mr. H. E. Amoore, December 11, 1905.

"An ideal wind-break." (*Amoore.*)

16788. NICOTIANA TABACUM. **Tobacco.**

From Morrinhos, State of Goyaz, Brazil. Selected by Mr. Antonio Borges Sampaio, of Uberaba, Minas-Geraes, and sent in by Dr. H. M. Lane, of Sao Paulo, Brazil. Received December 15, 1905.

"The famous *Morrinhos* tobacco. The tobacco grown in Sao Paulo and Goyaz is probably from seed brought from the Orient by the early Portuguese settlers, who took great pains to keep it pure. Goyaz is located in the mountainous region of Brazil, about 700 miles northwest of Rio de Janeiro, in latitude 16° S., where the mean annual temperature is 80°, with a maximum of 104° and a minimum of 25°." (*Lane.*)

16789 to 16796.

From Hangchow, China. Received thru Mr. Frederick D. Cloud, United States vice-consul, December 15, 1905.

16789. GLYCINE HISPIDA. **Soy bean.**

Yellow. An oil bean.

16790. GLYCINE HISPIDA. **Soy bean.**

Black. An excellent table bean.

16791. PHASEOLUS sp. **Bean.**

16792. ANDROPOGON SORGHUM. **Sorghum.**

16793. PHASEOLUS RADIATUS. **Mung bean.**

16794. VIGNA SESQUIPEDALIS (?).

"Grow with long pod and bear well. Used as a vegetable." (*Cloud.*)

16795. VIGNA SINENSIS (?). **Cowpea.**

"Very different from preceding. More prolific, shorter pod, and a better eating bean." (*Cloud.*)

16796. GLYCINE HISPIDA. **Soy bean.**

Black.

"All of these varieties are largely grown in China and, as in the case of the yellow soy bean, are very valuable. The black soy bean is extensively grown in the north for forage purposes and constitutes the principal article of food for horses, donkeys, and cattle. It is also a good table bean. This bean mixed with '*kaoliang*' (sorghum) seed, chopped grass, or straw, with a little bran, makes the very best horse feed. Perhaps the '*kaoliang*' is the most highly prized of all forage plants grown in China. No part of the plant goes to waste. Two or three weeks before the plant matures and the seed is ripe the farmer strips nearly all the blades from the plant, ties them in bundles, allows them to cure in the sun for a few days, and then stacks them away

16789 to 16796—Continued.

indoors. All thru the winter these blades are keenly relished by horses and donkeys. Then the seeds are gathered, combed out, and marketed. Several varieties of alcohol and wines are made from these seeds, and the deadly native drink 'sam-shu'—at least one variety of it—is made from '*kaoliang*' seed. The seed makes excellent feed for stock of all kinds. The long stalks are thrown on the thrashing floor, rolled flat by heavy stone rollers, carefully cleaned of all particles of pith, and woven into a great variety of mats and matting, suitable for use on floors, for window shades, or for the roofs of native houses and sheds. These stalks are also extensively used for fuel by the farming class. It is a most valuable crop and may be found thruout all the northern provinces. Not grown much as far south as Hang-chow.

"The yellow bean (16789) is the 'bean-cake' bean so extensively grown in the Manchurian provinces and is a most valuable crop. May be grown southward, but flourishes best in colder latitudes." (*Cloud.*)

THE PHILADELPHIA MUSEUMS APR 16 1907

INDEX OF COMMON AND SCIENTIFIC NAMES.

Abyssinian seeds, 11039 to 11119, 12371 to 12393.
Acacia sp., 12781.
aneura, 10475.
baileyana, 12790.
cultriformis, 15684.
cunninghamii, 15683.
elongata, 12791.
linearis, 12792.
longifolia, 11743.
lunata, 12793.
montana, 10476.
neriifolia, 10477, 15685.
prominens, 11744.
trinervata, 12794.
Acer carpinifolium, 13993.
circinnatum, 15932.
macrophyllum, 12236.
myabei, 13801.
Achras sapota, 11534.
Aconitum napellus, 12410, 12411, 12427, 12428.
Actinidia sp., 11629, 11630.
Adenocarpus frankenioides, 10727.
Adonis amurensis, 15781.
Aegilops speltoides, 16276.
squarrosa, 16254.
Afzelia quanzensis, 12360.
Agapanthus umbellatus 12239, 13803.
Agaricus sp., 13078, 13134.
Agave sp., 16159, 16198, 16206.
maculata, 11689.
Agriophyllum gobicum, 16316.
Agropyron sp., 16336.
divergens, 16337, 16338.
elmeri, 16339.
occidentale, 13441 to 13443, 13504, 16340, 16341.
pseudo-repens, 16342.
spicatum, 16343.
tenerum, 11129, 13092, 16344 to 16346.
Agrostis sp., 13877.
alba, 11130, 11640.
asperula, 14840.
Akee. See *Blighia sapida.*
Alchornea ilicifolia, 10478.
Aleurites cordata, 10410, 13104.
Alfalfa, (Algeria), 12803.
(Arabia), 12992.
(Argentina), 12549.
(Ecuador), 14972.
(France), 14496, 14497.
Alfalfa, (Italy), 13738, 13739, 13742 to 13745, 13751, 13753 to 13755, 13757 to 13759.
(Mexico), 11651, 11652.
(Russia), 10232 to 10235, 13857, 13858.
(Tunis), 12846, 12847.
Turkestan, 14786.
See also *Medicago* spp.
Algarobillo. See *Caesalpinia brevifolia.*
Allium sp., 16308.
cepa, 10988, 11761, 11762, 12719, 12720, 12732, 13088, 13859, 16313.
fistulosum, 12703.
Almond. See *Amygdalus communis.*
Alnus firma, 10529.
incana, 10530.
japonica, 10528.
maritima, 12802.
Alocasia sp., 15789, 15889.
cuprea, 15678.
macrorhiza, 15413.
variegata, 16773.
odora, 16774.
Aloe dichotoma, 11643.
Alopecurus castellanus, 16348.
Alphitonia ponderosa, 14429.
Alpinia caerulea, 10479.
Alsike. See *Trifolium hybridum.*
Althaea rosea, 13575, 13594, 13603, 13604.
Alyssum maritimum, 12964.
Amaryllidaceae, 16141, 16148, 16202.
Amatungulu. See *Carissa arduina.*
Ampelopsis veitchii purpurea, 11564.
Amphypterygium, 16207.
Amygdalus communis, 10338, 10558 to 10562, 12552, 12822 to 12831, 15831 to 15837.
hyb., 11255.
persica, 10335 to 10337, 10457, 11777, 15753, 15754, 15935.
Anacardium occidentale, 12809.
Ananas sativus, 11010, 11011, 11675, 14452.
Andropogon sp., 13880, 13882.
affinis, 14896.
contortus, 13873.
eucomus, 13889.
halepensis, 11131, 16471.
sericeus, 15949.
sorghum, 10327, 10612, 11058 to 11067, 11082 to 11085, 11119, 11132 to 11138, 11164, 11371, 11793, 12371 to 12374, 13316 to 13318, 13565, 14500 to 14775, 15825, 16792.

Anemone alpina sulphurea, 12994.
japonica, 16509, 16510.
Anise. See *Pimpinella anisum.*
Anona sp., 13137.
Anthericum sp., 16143.
Anthistiria ciliata, 13434.
Anthoxanthum odoratum, 11139, 13359.
Antirrhinum majus, 12987, 12988.
Apera arundinacea, 13623.
Apio. See *Arracacia esculenta.*
Apium graveolens, 10995, 16315.
Apple (Crimea), 10345 to 10348.
Misket, 10525, 13087.
Russian, 10261.
(Turkey), 13056.
See also *Pyrus malus.*
Apricot. See *Prunus armeniaca.*
Siberian. See *P. siberica.*
Aquilegia sp., 13624, 13625, 13627, 13628, 13645, 13722, 13723.
coerulea, 13020, 13021, 13640, 13726.
californica, 13024.
canadensis, 13022.
caryophylloides, 13637.
chrysantha, 13018, 13019, 13638.
clematidea hybrida, 13639.
ecalcarata, 13626.
flabellata, 13641.
glandulosa, 13023, 13642.
helenae, 13706.
skinneri, 13289, 13644.
stuarti, 13290.
truncata, 13643.
vulgaris compacta, 13660.
Arachis hypogaea, 10622, 11140, 11532, 12814, 14961, 14962, 15782 to 15787, 16161 to 16164, 16233 to 16236, 16472, 16483 to 16486.
Aralia cordata, 12140, 12452, 16506.
racemosa, 16231.
Aristida sp., 13879, 13892, 13899, 15334.
Armeria formosa hyb., 13694.
Arracacia esculenta, 15374.
Arrhenatherum elatius, 11141, 11143, 16245, 16255, 16349.
Artemisia argentea, 10676.
Artichoke. See *Cynara scolymus.*
Chinese. See *Stachys sieboldii.*
Arundinaria simoni, 11641.
Arundinella ecklonii, 13886.
Ash. See *Fraxinus* sp.
Asparagus crispus, 14984.
duschesnii, 13319.
virgatus, 11733, 12898.
Asphodelus ramosus, 10675.
Astrebla triticoides, 15950.
Atriplex confertifolia, 13556.
coronata, 13553 to 13555, 13557.
holocarpa, 12778, 15947.
leptocarpa, 15948.
nummularia, 12777.
semibaccata, 11142, 12735.
Atropa belladonna, 12900.
Avena sp., 13812, 13968.
brevis, 16277.
Avena flavescens, 16350.
hirsuta, 16278.
ludoviciana, 16279.
orientalis, 16280, 16351.
planiculmis, 14841, 16281.
sativa, 10183 to 10193, 10269, 10271, 10278, 10279, 10321, 10330, 10354 to 10359, 10455, 10624, 11144 to 11151, 11655, 11722, 12133, 12303, 12877 to 12882, 13090, 13091, 13576, 13577, 14802, 15655, 15797, 15798, 16856 to 15864, 16352.
strigosa, 16282.
Avocado. (Canary Islands), 16170.
(Florida), 12933 to 12937, 13729 to 13731, 15656.
(Guatemala), 10978, 13292.
(Hawaii), 10615 to 10620.
(Mexico), 14435, 14889, 14890.
(Natal), 11724.
See also *Persea gratissima.*
Bactris major, 14458.
Balsamorhiza sp., 11676.
Balsam-root. See *Balsamorhiza* sp.
Bamboo. See *Arundinaria simoni*, *Bambusa striata*, *Bambusa vulgaris*, and *Phyllostachys* spp.
Bambusa striata, 12757.
vulgaris, 14447.
Banana. See *Musa sapientum.*
Barberry. See *Berberis* sp.
Barberton daisy. See *Gerbera jamesoni.*
Barley. (Central Asia), 16329.
(England), 10360 to 10363.
(Finland), 10270.
(Germany), 13346.
Hanna, 10402, 11622, 12125, 12993, 15867.
(India), 14964, 14965.
(Minnesota), 10674.
(Norway), 13578.
Oderbrucker, 10754.
Russian, 10219 to 10222.
Swedish, 10275, 10276, 10583 to 10586.
See also *Hordeum* spp.
Barringtonia alba, 10480.
Bean, broad, 10406, 10411 to 10448, 10535 to 10543, 10991, 13779 to 13785.
horse, 10724, 10753, 10962, 11697, 11759, 13784, 13785, 14468, 14880, 14881, 15428, 15429.
soy. See *Glycine hispida.*
velvet. See *Mucuna utilis.*
See also *Phaseolus* spp. and *Vicia* spp.
Beet, (Sicily), 10628 to 10630.
sugar, 11152 to 11163, 11237 to 11251, 11355 to 11368, 12394, 12744, 12745, 12918, 13952 to 13966.
See also *Beta* spp.
Begonia sp., 10465, 10575, 11345, 11597 to 11599, 11692, 12733.
Belamcanda punctata, 13236.
Bellflower, Chilean, 14948.
Bellis perennis, 13703.

Berberis sp., 13347.
amurensis, 13351.
fremonti, 12242.
sieboldii, 13353.
sinensis, 13352, 13976.
thunbergii, 13977, 13978.
vulgaris, 13979 to 13985.
Berseem. See *Trifolium alexandrinum*.
Beschorneria bracteata, 15751.
Beta cicla, 10531.
maritima, 10629, 10630.
vulgaris, 10628, 10989, 11152 to 11163, 11237 to 11251, 11355 to 11368, 12394, 12744, 12745, 12918, 13952 to 13966, 14804.
Bidens heterophylla, 14488.
Bird's-foot trefoil. See *Lotus corniculatus*.
Bitoom. See *Pistacia atlantica*.
Black jube. See *Diospyros lotus*.
Blandfordia flammea, 10481.
Blennodia lasiocarpa, 10482.
Blighia sapida, 10557, 16224.
Bloodwood. See *Eucalyptus corymbosa*.
Bloomeria aurea, 13818.
Boltonia glastifolia, 13665.
Bosea yervamora, 10677, 10728.
Bossiaea rhombifolia, 12795.
Bouteloua curtipendula, 13566.
Brachypodium pinnatum, 16256.
Brassica sp., 10245 to 10247, 11081, 15811, 15813, 16310, 16325.
alba, 10982, 10983.
chinensis, 14957.
napus, 10243, 10244, 11165, 11684, 13733, 13787 to 13793, 16193, 16304.
nigra, 12756.
oleracea, 12813, 16312.
botrytis, 13000.
pe-tsai, 10981, 10984, 10994, 10997, 15812.
rapa, 12727, 12728, 15315 to 15320.
Brome-grass. See *Bromus* spp.
Bromus sp., 15956 to 15959, 16353.
adoensis, 15960.
alopecurus, 15961.
altissimus, 15962.
andinus, 14842, 15963.
angustifolius, 15964, 15965.
arduennensis, 15966 to 15969.
villosus, 15970.
arenarius, 15971.
arvensis, 15972.
asper, 15973.
biebersteinii, 15974.
brachystachys, 15975.
breviaristatus, 15976, 15977.
brizaeformis, 15978.
canadensis, 15979 to 15983.
carinatus, 15984, 16354 to 16358.
hookerianus, 13444, 13445.
ciliatus, 15985 to 15994.
commutatus, 15995, 15996.
condensatus, 15997.
confertus, 15998.
congestus, 15999.
Bromus crinitus, 16000.
danthoniae, 16001.
diandrus, 16002.
erectus, 16003, 16283.
laxus, 16004.
transilvanicus, 16005.
villosus, 16006.
fibrosus, 16007.
fimbriatus violaceus, 16008, 16009.
giganteus, 16010.
triflorus, 16011.
grossus, 16012.
gussoni, 16013, 16014.
hookerianus, 16015.
hordeaceus, 16016.
glabrescens, 16017.
inermis, 10226, 11166, 13446, 13795, 15884, 16018 to 16022, 16171 to 16174, 16359.
intermedius, 16023.
interruptus, 16024.
japonicus, 16025, 16026.
kalmii, 16027, 16028.
krausei, 16029, 16030.
laevipes, 16031, 16032.
laxus, 16033 to 16035.
longiflorus, 16036 to 16038.
macranthus, 16039.
macrostachys, 16040, 16041.
lanuginosus, 16042.
madritensis, 16043 to 16045.
delilei, 16046.
marginatus, 13370, 13447, 13505, 16047, 16048, 16360 to 16366.
maximus gussoni, 16049.
mollis, 16050, 16051.
glabratus, 16052.
lloydianus, 16053.
thominii, 16054.
multiflorus, 16055.
pacificus, 15875.
parviflorus, 16056.
patulus, 16057, 16058.
nanus, 16059
pendulus, 16060.
pitensis, 16061, 16062.
polyanthus, 16367, 16368.
paniculatus, 13448, 16369.
porteri frondans, 16063.
pubescens, 16064.
pumpellianus, 16065, 16066.
pungens, 16067.
ciliatus, 16068.
purgans, 16069 to 16074.
purpurascens, 16075, 16076.
racemosus, 16077 to 16084.
richardsoni, 16085.
rigidus, 16086.
rubens, 16087, 16088.
schraderi, 16089, 16090.
secalinus, 16091, 16092.
multiflorus, 16093.
segetum, 16094.
sitchensis, 16370.
squarrosus, 16095 to 16101.
villosus, 16102.

Bromus squarrosus wolgensis, 16103.
  stenophyllus, 16104.
  sterilis, 16105.
  tacna, 16106 to 16108.
  tectorum, 16109, 16110.
  trinii, 16111.
  unioloides, 11167, 16112 to 16122.
    willdenowii, 16123.
  valdivianus 16124.
  variegatus, 16125.
  vestitus, 16126.
  virens, 16127.
  willdenowii, 16128.
Broom corn. See *Andropogon sorghum.*
Brucea sumatrana, 11681.
Brunonia australis, 10483.
Bryonia alba, 12440.
  dioica, 12441.
Buckwheat. See *Fagopyrum* spp.
Butternut. See *Juglans cinerea.*
Bystropogon origanifolius, 10678, 10729.
Cabbage. See *Brassica oleracea.*
Cacao. See *Theobroma cacao.*
Caesalpinia sp., 14437.
  brevifolia, 10631, 11792.
  kauaiensis, 14425.
Caladium sp., 15378.
  esculentum 13293 to 13297.
Calamagrostis hyperborea, 13449.
Calathea sp., 16505,16763.
  arrecta, 16766.
  intermedia, 16499.
  makoyana, 16767.
  ornata majestica, 16495.
  pulchella, 16987.
  roseo-picta, 16768.
  undulata, 16769.
  vandenheckei, 16498.
  warscewiczii, 16500.
Calendula officinalis, 12979, 12980.
Calla. See *Richardia africana.*
Calliandra grandiflora, 11593, 11688.
Calliopsis. See *Coreopsis.*
Callitris calcarata, 15686.
  robusta, 15687.
Calophyllum calaba, 11653.
  hasskarlii, 11021.
  inophyllum, 10463, 12110.
  kunstleri longifolium, 11022.
  spectabile, 11023, 11024, 11025.
  venulosum, 11026.
Calyptrogyne dulcis, 16482.
Campanula amabilis, 13721.
  glomerata acaulis, 13707, 13720.
  media, 13025, 13026, 13591.
  pyramidalis, 13286, 13288, 13589, 13590.
Camphor. See *Cinnamomum camphora.*
Canarium album, 11271.
Cannabis sativa, 10241, 10242, 10281, 10979, 12849, 16332.
Cape gooseberry. See *Physalis* spp.
Capparis mitchellii, 10485.
Capriola dactylon, 11169, 13878, 15779.
Capsicum annuum, 10392 to 10396, 10755, 10756, 11639, 11741, 11742, 14484, 14485.
Capsicum frutescens, 11108.
Caragana arborescens, 12913, 15475.
  microphylla, 12912.
Carica papaya, 13103, 14449.
Carissa arduina, 11734, 13239, 13967.
Carpodetus serratus, 11745.
Carthamus tinctorius, 11115, 16324.
Carum ajowan, 12431.
  carvi, 12414, 12901.
  gairdneri, 12932, 16223.
Cascara sagrada. See *Rhamnus purshiana.*
Cashew nut. See *Anacardium occidentale.*
Casimiroa edulis, 14454.
Cassava. See *Manihot* sp.
Cassia angustifolia, 12442.
Cassinnia theodorei, 10484.
Castanea crenata, 12773, 13130.
  sativa, 13131.
  vesca, 12681.
Castanospora alphandi, 10486.
Castilla costaricana. 11657.
  elastica, 10975, 14450.
Castor oil. See *Ricinus* spp.
Casuarina stricta, 15688.
  suberosa, 12796.
  torulosa, 13689.
Catispa, 16134.
Cauliflower. See *Brassica oleracea botrytis.*
Cebadilla. See *Schoenocaulon officinale.*
Cedar, giant. See *Thuja gigantea.*
Cedar of Lebanon. See *Cedrus libani.*
Cedrela odorata, 11769.
Cedronella canariensis, 10730.
Cedrus libani, 11258.
Celery. See *Apium graveolens.*
Celtis paniculata, 10487.
Centaurea sp., 11114.
  calcitrapa, 10679.
  cyanus, 12977.
Centranthus ruber, 13608, 13609.
Centrosema plumieri, 15852.
Cephalaria tatarica, 13360, 13361, 13852.
Cerastium biebersteinii, 13612.
Cercidiphyllum japonicum, 11624.
Cereus validus, 12404.
Ceruella, 14434, 14456.
Chaetochloa sp., 13887, 13911, 13919.
  aurea, 13910.
  glauca, 14905.
  italica, 10613, 11168, 11220, 11496, 15827.
  nigrirostre, 13912.
  pennisetum, 13914.
Chamaedorea sp., 11012 to 11017.
Chayote. See *Sechium edule.*
Cheirodendron gaudichaudii, 14423.
Chenopodium anthelminticum, 12908.
Cherry, flowering. See *Prunus pseudocerasus.*
  Japanese bush, 15810.
  Mexican, 11636.
  Russian, 10260, 10580 to 10582, 11034.
  See also *Prunus* spp.
Chestnut. See *Castanea* spp.
Chick-pea. See *Cicer arietinum.*
Chilopsis saligna, 15807.

hloris sp., 15355.
  truncata, 10488.
  virgata, 13895, 13901, 15337.
    elegans, 15340.
hrysanthemum anethifolium, 12872.
  frutescens, 10681, 10731.
  leucanthemum hyb., 13313 to 13315.
hrysopsis hispida, 11771.
icer arietinum, 10973, 10974, 11095, 11109, 11110, 11170, 11634, 12393, 13362 to 13369, 16320.
ineraria populifolia argentea, 10680.
innamomum camphora, 13808, 14464, 14884.
iruela, or Ciruella. See *Spondias* sp.
itrange. See *Citrus* hyb.
itrullus vulgaris, 10249, 12718, 12771, 15758, 15764, 15766, 15929, 15930, 16306.
itrus sp., 12141, 13263.
  aurantium, 10970, 12687 to 12690, 12692.
  australasica, 14993.
  bigaradia, 12691.
  decumana, 11661 to 11673, 14907.
  hyb., 13002 to 13006.
  limetta, 10365.
  limonum, 12686.
Clematis sp., 11539 to 11563, 13929 to 13932, 13936 to 13939, 13941 to 13945.
  coccinea, 13927.
  davidiana, 13863.
  flammula, 13925.
  fortunei, 11522.
  indivisa, 13926.
  integrifolia durandii, 13946.
  jackmani, 11558 to 11560, 13933, 13934.
  lilacina floribunda, 13935.
  reticulata, 11557.
  standishi, 13940.
Clethra arborea, 10732.
Clianthus dampieri, 15953.
Clitoria ternatea, 13862.
Clivia miniata. 15676.
Clover, bur. See *Medicago denticulata* and *M. maculata*.
  crimson. See *Trifolium incarnatum*.
  (England), 13772 to 13777.
  (France), 14493 to 14495.
  (Greece), 12927 to 12929.
  (Italy), 13734 to 13737, 13740, 13741, 13746 to 13749, 13752, 13756, 13770, 13771.
  (Japan). See *Lespedeza striata*.
  (New Zealand), 12890, 12891.
  (Norway), 13581.
  red. See *Trifolium pratense*.
  Russian, 10254, 10532 to 10534, 10563 to 10567, 10577, 10626, 10627.
  sweet. See *Melilotus* spp.
  (Uganda), 10352.
  white. See *Trifolium repens*.
  wild Russian, 10254.
  See also *Trifolium* spp.
Cochlearia armoracia, 10462, 10576.
  officinalis, 15849.
Coffea sp., 11078, 11354, 11504, 12380 to 12382.
  zanguebariae, 12897.
Colchicum autumnale, 12436.
Colocasia sp., 13086, 15381, 15382, 15395, 16775.
  antiquorum esculentum, 15372, 15373, 15941.
    euchlora, 16776.
  fontanesii, 15797.
  illustris, 15796.
  indica, 16777.
Combretum loeflingii, 10489.
Commelina coelestis, 13614.
Conium maculatum, 12902.
Convolvulus sp., 10623.
  althaeoides, 10682.
  floridus, 10683.
Cordyline australis, 15690.
  obtecta, 15691.
  stricta, 15692.
Coreopsis sp., 12972.
  coronata, 12976.
  drummondii, 12974.
  grandiflora, 12973.
  lanceolata, 12971, 13629, 13630.
  tinctoria, 12975.
Coriandrum sativum, 11077, 11101, 12903, 16307.
Corn (Central Asia), 16330.
  (India), 14971.
  (Mexico), 14459.
  (Russia), 16190.
  sweet, 10400, 10401, 12557 to 12563, 12697, 13143 to 13153, 13570, 16770, 16772, 16781 to 16784.
  (Turkey), 15775.
  See also *Zea mays*.
Cornus kousa, 12755.
  macrophylla, 13994, 13995.
Coronilla varia, 10252.
Corylus avellana, 10343, 10344, 12833, 12834.
Cosmos bipinnatus, 12989.
Cotoneaster angustifolia, 13242.
Cotton (Australia), 14885 to 14887.
  (Guatemala), 13094 to 13101.
  (Peru), 13583 to 13585, 14801, 14870, 14945, 14946.
  tree. See *Gossypium arboreum*.
  wild, 13079, 13238.
  See also *Gossypium* spp.
Cowpea. See *Vigna sinensis*.
Craspedia richea, 10490.
Crataegus sp., 12548.
Crocus sp., 15441, 15442.
Crucianella stylosa, 13616.
Cucumis sp., 11774.
  melo, 10248, 10553 to 10556, 11796, 12108, 12109, 12669, 12770, 13341 to 13345, 13355, 15672, 15755 to 15757, 15765, 15776, 16319.
  sativus, 12717, 12863, 16322.

Cucurbita sp., 10310, 12704, 12729, 12749, 12750, 12843 to 12845, 15670, 15671, 15816, 15817, 15937, 16331, 16476.
  melanosperma, 14874.
Cupania sapida. See *Blighia sapida.*
Curcuma amada, 16194.
  longa, 16196.
Custard apple, wild, 13137.
Cydonia sp., 13158.
Cynara scolymus, 12862, 15945, 15946.
Cyperus sp., 14483.
  papyrus, 10568, 12710.
Cyphomandra betacea, 12758.
Cytisus glabratus, 10684.
  palmensis, 10685, 10734.
  proliferus albus, 15927.
  scoparius, 15851.
Dactylis aschersoniana, 14843.
  glomerata, 11171, 12895, 15668, 16371, 16372.
Dahlia sp., 10572, 12367, 12449, 12450, 12564, 13283, 13727.
  chisholmi, 10573.
  imperialis, 14995.
  merckii, 12738.
  variabilis, 13705.
Danthonia semiannularis, 15952.
Dasylirion sp., 16205.
Date. See *Phoenix dactylifera.*
Date plum. See *Diospyros lotus.*
Daucus carota, 14805, 16318.
Davidia involucrata, 12137, 16208.
Delphinium sp., 12769.
  ajacis hyacinthiflorum, 13661.
  chinense, 13595.
  elatum, 13104, 13685.
  formosum, 13015, 13016, 13597.
  grandiflorum, 13012, 13013, 13596.
  hyb., 13017, 13714.
  imperiale, 13662.
  staphisagria, 10686, 10735, 12420, 12433.
  sulphureum, 13598.
Deschampsia caespitosa, 16373.
Desert willow. See *Chilopsis saligna.*
Deutzia myriantha, 16511.
  vilmorinae, 16512.
Dianella tasmanica, 10491.
Dianthus barbatus, 13587, 13588, 13600 to 13602, 13670 to 13673, 13695.
  barbatus × *D. chinensis*, 13647.
  caryophyllus, 13699 to 13702, 13708, 13709.
  chinensis, 13682, 13684.
  elatum, 13683.
  heddewigii, 13008.
  imperialis, 13659.
  plumarius, 13657, 13716, 13717, 13719.
Dieffenbachia sp., 15763.
  seguine, 15679.
Digitalis canariensis, 10687, 10736.
  grandiflora, 13592.
  lutea grandiflora, 13593.
  purpurea, 12699, 13009 to 13011.
Dillwynia cinerascens, 10492.
Dioscorea sp., 10590 to 10593.
  divaricata, 10311, 10312.
Diospyros ebenum, 16487.
  kaki, 13819 to 13851.
  lotus, 15780.
Diplopappus chrysophyllus, 13712.
Dodecatheon meadia, 12776.
Dodonaea triquetra, 10493.
  viscosa, 12797, 14430.
Doekoe. See *Lansium domesticum.*
Dolichos biflorus, 13371, 13372.
  lablab, 13373 to 13376.
  uniflorus, 12752.
Doum palm. See *Hyphaene crinita.*
Dracaena aurea, 14427.
  draco, 10688.
Dracontium asperum, 15805.
Dracunculus canariensis, 10689.
Durian. See *Durio zibethinus.*
Durio zibethinus, 15886.
Dysoxylon muelleri, 10494.
Ecballium elaterium, 12421, 12426.
Echeandia sp., 16154.
  paniculata, 13281.
Echinacea sp. × *E. peleanthus*, 13725.
  angustifolia, 12424, 12425.
Echinocystis sp., 13816, 13817.
Echinops ritro, 13619.
Echium formosum, 10690.
  simplex, 10691.
  strictum, 10692.
Edgeworthia gardneri, 12142.
Eecha, 13142.
Ehrharta stipoides, 14901.
Einkorn. See *Triticum monococcum.*
Elaeagnus angustifolia, 10371, 10372.
Elaeocarpus cyaneus, 12798.
Elaeodendron curtipendulum, 10495.
Eleusine coracana, 11100, 12390.
  tocusso, 16257.
Elionurus argenteus, 13881.
Elymus canadensis, 15955, 16374.
  chubutensis, 14844.
  condensatus, 13450.
  triticoides, 13451.
  sabulosus, 14845.
  virginicus submuticus, 13452, 16375, 16376.
Emilia sonchifolia, 12981.
Emmer. See *Triticum dicoccum.*
Enterolobium cyclocarpum, 11592.
Eragrostis sp., 13867, 13868, 13875, 13876, 13885, 13896, 13897, 13900, 13904, 13906, 15338, 15342, 15358, 15359.
  abyssinica, 11117, 11118, 12378, 12385, 12386, 14470.
  brownii, 14897.
  chloromelas, 13871.
  lappula divaricula, 13884.
  leptostachya, 14898.
  major megastachya, 13921
  pilosa, 12799, 14899.
  plana, 13883.
Eremophila bowmani, 10501.
  brownii, 10496.

Eremophila latifolia, 10497.
  maculata, 10498.
  mitchelli, 10499.
  oppositifolia, 10500.
Eriobotrya japonica, 11631, 12832, 15809.
Eriodendron anfractuosum, 14813.
Eriostemon difformis, 10502.
Erodium chelidonifolium, 16216.
  daucoides, 12618.
  glandulosum, 16219.
  gruinum, 16258, 16284.
  hymenodes, 16215.
  macradenum, 16220.
  macrophyllum, 16222.
  manescavi, 16221.
  pelargonifolium, 16217.
  stephanianum, 16259.
Ervum lens, 10236, 10237, 10752, 11080, 11105, 14462.
Erythrina coralloides, 13282.
  monosperma, 14426.
Eschscholtzia californica, 12873.
Eucalyptus behriana, 10503.
  botryoides, 11747.
  coccifera, 10505.
  corymbosa, 16786.
  corynocalyx, 11736.
  diversicolor, 10504.
  goniocalyx, 16227.
  incrassata, 10506.
  longifolia, 11748.
  tereticornis, 10507.
  virgata, 10508.
Euchlena mexicana, 11172, 11480.
Eucommia ulmoides, 12136.
Eupatorium portoricense, 14999.
Euphorbia sp., 13140.
  canariensis, 10693.
  regis-jubae, 10694.
Eutelea arborescens, 11746.
Eutrema hederaefolia, 10579.
  wasabi, 12451.
Fagopyrum esculentum, 10569, 11173.
  tataricum, 14969.
Feijoa sp., 15818 to 15820.
  sellowiana, 12850.
Fenugreek. See *Trigonella foenum-graecum*.
Ferula linkii, 10695.
Festuca arundinacea, 16377.
  elatior, 11174, 16378.
  gigantea, 15826.
  heterophylla, 11175.
  hyb., 16379.
  ovina, 11176.
    ingrata, 16244.
  pabularis, 10976.
  pratensis, 11177, 11482, 13453, 16380.
  reflexa, 16381.
  rubra, 11178.
Ficus sp., 12780, 13138, 14438.
  glomerata, 12111.
  rubiginosa, 15693.
Fig. See *Ficus* spp.
Filbert, Crimean, 10343, 10344.
  See also *Corylus avellana*.
Flax, Russian, 9897 to 10167, 10315 to 10317, 10379 to 10381, 12744.
  See also *Linum usitatissimum*.
Foeniculum dulce, 12700, 16309.
Footah, 13140.
Fragaria sp., 10751.
Francoa ramosa hybrida, 13718.
Fraxinus sp., 11635.
Freesia sp., 14788, 14799.
  refracta alba, 14985.
Freycinetia arborea, 12104.
Fukuji, 16787.
Furcraea foetida, 10967.
Furze. See *Ulex europaeus*.
Gaillardia sp., 11770, 13605.
  perennis, 13666.
Galilea juncea, 10696, 10737.
Gamboge. See *Garcinia morella*.
Garbanzo. See *Cicer arietinum*.
Garcinia cochinchinensis, 12021, 16477.
  cornea, 11721.
  cowa, 11785, 11787.
  dioica, 11027.
  dulcis, 11028, 11029.
  ferrea, 16478.
  fusca, 11030.
  hanburyi, 16479.
  indica, 11501, 16480.
  livingstonei, 11483, 12811, 12960.
  loureiri, 11031.
  mangostana, 11725, 11732, 11786, 12022, 13135, 13572, 13800, 13987, 16131.
  morella, 10522, 11478, 11790, 12693.
  spicata, 11789, 16787.
  xanthochymus, 11032, 11784, 11788, 12019, 13349.
Genista canariensis, 10697.
  monosperma, 10698.
Gerardia tenuifolia hyb., 13667.
Gerbera jamesoni, 14432.
Ginseng. See *Panax ginseng*.
Gladiolus sp., 14073 to 14087, 14128 to 14132, 14317 to 14334, 14409, 14411.
  alatus, 15594.
  childsii, 14006 to 14034, 14268 to 14285.
  cruentus, 14000.
  dracocephalus, 14002, 14102 to 14109.
  gandavensis, 12368, 14035 to 14061, 14156 to 14204, 14260 to 14265, 14371 to 14407.
  hyb., 12682, 14079.
  kelwayi, 14335 to 14370, 14408, 14410, 14412.
  leichtlini, 14005.
  lemoinei, 14062 to 14072, 14088 to 14101, 14133 to 14142, 14205 to 14236, 14266, 14267, 14286 to 14316.
  nanceianus, 14110 to 14127, 14143 to 14155, 14237 to 14259.
  psittacinus, 14003.

- *Gladiolus purpureo-auratus*, 14001.
  - *saundersii*, 14004.
  - *segetum*, 10699.
- *Glaucium flavum*, 13668.
- *Gleditschia* sp., 10251.
- *Glycine hispida*, 11179, 11180, 12399, 12400, 13502, 13503, 14952 to 14954, 16789, 16790, 16796.
- *Glycyrrhiza glabra*, 13574.
- *Gonospermum fruticosum*, 10700.
  - *revolutum*, 10701, 10738.
- Gooseberry. See *Ribes grossularia*.
- Gorse. See *Ulex europaeus*.
- *Gossypium* sp., 11045 to 11048, 11187 to 11190, 11502, 11775, 11776, 12306, 12938, 13079, 13238, 13583 to 13585, 14469, 14801, 14870, 14885 to 14887, 14945, 14946.
  - *arboreum*, 10403, 10404.
  - *barbadense*, 11181 to 11186, 11343.
  - *herbaceum*, 11263.
  - *hirsutum*, 13094 to 13101.
  - *tomentosum*, 10964.
- Gourd, Japanese, 10309, 10310.
  - See also *Cucurbita* spp. and *Lagenaria* spp.
- Grape (Algeria), 13133.
  - (Central Asia), 10331 to 10334, 10598 to 10609.
  - Crimean, 10340 to 10342.
  - (France), 11372 to 11477, 12940 to 12957.
  - See also *Vitis vinifera*.
- Grass, Australian bluegrass. See *Andropogon sericeus*.
  - Bermuda. See *Capriola dactylon*.
  - brome. See *Bromus* spp.
  - canary. See *Phalaris canariensis*.
  - cane. See *Stipa tuckeri*.
  - esparto. See *Stipa tenacissima*.
  - guinea. See *Panicum maximum*.
  - Johnson. See *Andropogon halepensis*.
  - Hungarian. See *Setaria italica*.
  - Kentucky bluegrass. See *Poa pratensis*.
  - love. See *Eragrostis* spp.
  - meadow fescue. See *Festuca pratensis*.
    - rice. See *Microlaena stipoides*.
  - Mitchell. See *Astrebla triticoides*.
  - orchard. See *Dactylis glomerata*.
  - pigeon. See *Chaetochloa glauca*.
  - red fescue. See *Festuca rubra*.
  - redtop. See *Agrostis alba*.
  - rescue. See *Bromus unioloides*.
  - rice. See *Ehrharta* sp.
  - rye. See *Lolium* spp.
  - sheep's fescue. See *Festuca ovina*.
  - slender wheat. See *Agropyron tenerum*.
  - summer. See *Panicum sanguinale*.
- Grass, sweet vernal. See *Anthoxanthum odoratum*.
  - tall fescue or meadow fescue. See *Festuca elatior*.
  - velvet. See *Holcus lanatus*.
  - wallaby. See *Danthonia semiannularis*.
  - wild, 10227 to 10231.
- *Grevillea linearis*, 10515.
  - *robusta*, 11749.
- Ground cherry. See *Physalis* spp.
- Guava. See *Psidium guajava*.
- Guayabillo. See *Psidium* spp.
- Guerrero. See *Eupatorium portoricense*.
- *Guilleminea illecebroides*, 11594, 11685.
- *Guizotia oleifera*, 11093, 11107, 12389.
- Gum tree. See *Eucalyptus* spp.
- *Hedysarum coronarium*, 10325, 13989, 14991.
- *Helenium grandicephalum*, 13697, 13698.
- *Helianthus* sp., 11660, 11773.
  - *annuus*, 10223 to 10225, 11191.
  - *multiflora*, 12963.
- *Helichrysum bracteatum*, 12986.
- Hemp, Chinese, 10979.
  - Russian, 10241, 10242.
  - Swedish, 10281.
  - See also *Cannabis sativa*.
- *Hesperaloë funifera*, 13805.
- *Heteropogon contortus*, 13873.
- *Hevea* sp., 15885.
- *Hibiscus* sp., 14439.
  - *sabdariffa*, 16785.
- *Hicoria* sp., 11254, 11256.
  - hyb., 11628.
- *Hippeastrum* sp., 13807.
- *Holcus lanatus*, 12405, 13377, 16247.
- Holly. See *Ilex crenata*.
- Hollyhock. See *Althaea rosea*.
- *Homalomena wallisi*, 15762, 16504.
- *Homeria discolor*, 15680.
- Honey locust. See *Gleditschia* sp.
- Hop. See *Humulus lupulus*.
- *Hordeum* sp., 11040 to 11044, 11116, 12124, 12375, 12376, 13578, 13969, 15821, 16329.
  - *bulbosum*, 13562.
  - *distichum*, 10362, 10363, 12023, 12121.
    - *erectum*, 10586, 12119, 12129.
    - *nutans*, 10402, 10583 to 10585, 11622, 12116 to 12118, 12125 to 12128, 12993, 13346, 15867.
  - *hexastichum*, 10360, 10361, 12122.
  - *tetrastichum*, 10674, 10754, 11623, 11716, 11717, 12120, 12709.
  - *vulgare*, 10219 to 10222, 10270, 10275, 10276, 10985, 11192, 11193, 11264, 11265, 11620, 11621, 11658, 11678, 11780, 12123, 13854, 14964, 14965, 15799, 15829, 15830, 15866.

Horse-radish. See *Cochlearia armoracia.*
Japanese. See *Eutrema wasabi.*
Malin, 10462, 10576.
Hovea heterophylla, 10509.
Humulus lupulus, 11683, 12805 to 12807.
Husk tomato. See *Physalis* spp.
Hyacinthus sp., 15430 to 15434, 15457, 15458, 15896 to 15904.
orientalis, 12233, 12244 to 12257, 14790, 15806.
Hydrangea scandens, 12961.
Hydrastis canadensis, 13864.
Hymenocallis sp., 16142, 16147.
littoralis, 10571.
Hymenosporum flavum, 11750.
Hyoscyamus niger, 12412, 12429.
Hypericum floribundum, 10702.
Hyphaene crinita, 11269.
Iberis amara, 13007.
coronaria princeps, 13286.
Ibervillea sp., 16201, 16481.
sonorae, 16200.
Ilex crenata, 10449.
Impatiens holstii, 13710.
Incarvillea delavaya, 13620, 13713.
Ipomoea sp., 12401, 12958.
batatas, 14480, 16175 to 16188.
hederacea, 13080 to 13083.
pes-caprae, 11723.
Iris sp., 12370, 13227 to 13230, 15646 to 15654.
ensata pabularia, 16334.
gracilipes, 13231.
hispanica, 15739 to 15743.
kaempferi, 13159 to 13226.
laevigata, 13233 to 13235.
sibirica, 13232.
Ischnosiphon hirsuta, 16501.
Isolepis canariensis, 10733.
Jacaranda ovalifolia, 11642.
Juglans sp., 14997.
cinerea, 11257.
hyb., 10587, 11252.
nigra, 11253.
regia, 10339, 12114, 13573.
Juncus effusus, 12804, 13264, 13621, 14482, 16490.
conglomeratus, 14778, 16491 to 16494.
setchuensis, 13622.
Kafir corn. See *Andropogon sorghum.*
Kapoelasan. See *Nephelium mutabile.*
Karoobosch. See *Pentzia virgata.*
Kennedya rubicunda, 12800.
Kniphofia sp., 13632.
hyb., 13631.
Kochia scoparia, 12990, 13077.
Kosam. See *Brucea sumatrana.*
Kosteletzkya pentacarpa, 10614.
Kulthi. See *Dolichos uniflorus.*
Kunzea pomifera, 15882.
Lactuca sativa, 10996, 10998, 10999.
Lagenaria vulgaris, 16332.
Landolphia sp., 11654.
Lansium domesticum, 12238, 13728, 13986.
sumatrana, 11484.
Lapageria rosea, 14948.
Lappago racemosa, 16285.
Larkspur. See *Delphinium* spp.
Lathyrus sp., 14966.
azureus, 11195, 16382.
cicer, 13379.
coccineus, 11196, 16383.
ochrus, 16384.
odoratus, 12359, 13306 to 13312.
sativus, 10375, 11197 to 11199, 13378, 16385 to 16387.
silurus, 16137.
stipularis, 11194.
sylvestris, 10255, 12361.
tingitanus, 11200, 16388, 16389.
Lavandula abrotanoides, 10703.
vera, 12413, 12430.
Leaf beet. See *Beta cicla.*
Leitchee, or litchi. See *Nephelium litchi.*
Lemon. See *Citrus limonum.*
Lemoncito, 14433.
Lens esculenta. See *Ervum lens.*
Lentil, Russian, 10236, 10237.
See also *Ervum lens.*
Lepidium sativum, 11096.
Leptosyne stillmanni, 13669.
Lespedeza japonica, 13811.
striata, 11201, 11479, 16474, 16475.
Lettuce. See *Lactuca sativa.*
Leucophae candidissima, 10704, 10739.
Liatris sp., 11772.
scariosa, 11718, 11719.
Licorice. See *Glycyrrhiza glabra.*
Lilium sp., 11008, 11565 to 11589, 12565, 15933.
alexandrae, 12143.
auratum, 12144.
batmanniae, 11565, 12145.
brownii, 11580, 12146.
candidum, 15944.
columbianum, 15891.
concolor, 11566 to 11569, 12148.
cordifolium, 11570, 12147.
dahuricum, 11576.
elegans, 11571 to 11575.
giganteum, 12364.
hansoni, 11577, 12149.
humboldtii, 15890.
hyb., 13106, 15893, 15894.
japonicum, 11578, 11580, 12146.
krameri, 12150.
leichtlinii, 11581, 12151.
longiflorum, 11582, 12152.
eximeum, 11728 to 11730, 14481, 15478, 15746.
eximium giganteum, 11583, 11590, 11591, 15479, 15584, 15942.
multiflorum, 11794, 15943.
medeoloides, 11584, 12153.
mexicanum, 11686.
neilgherrense, 10963, 11649, 12896.
pardalinum, 12680, 15892, 15895.
× *humboldtii*, 15894.

Lilium pardalinum × *parvum*, 15893.
  philippinense, 10966, 12235, 14812.
  rubellum, 11579.
  speciosum, 11585 to 11588.
    album, 12154.
  tigrinum, 12155.
Lily (Mexico), 10571.
  See also *Lilium* spp.
Lime, Finger. See *Citrus australasica*.
  (India), 10365.
  See also *Citrus limetta*.
Linum austriacum, 10147.
  usitatissimum, 9897 to 10167, 10315 to 10317, 10378 to 10381, 11079, 11113, 11267, 12391, 12774, 16321.
Lippia repens, 11682, 12819.
Lobelia sp., 13606, 13607.
  inflata, 12904.
  tenuior, 13711.
Lolium bonaerensis, 13797, 16390.
  italicum, 11202, 12892, 13339.
  perenne, 10588, 11203, 11481, 12893, 16391 to 16394.
Longan. See *Nephelium longanum*.
Loquat. See *Eriobotrya japonica*.
Lotus americanus, 16395, 16396.
  canariensis floribunda, 10705.
  corniculatus, 10253, 11204, 13750, 16397.
  tetragonolobus, 10398, 16398.
Lupine. See *Lupinus* spp.
Lupinus sp., 11637.
  affinis, 11205.
  angustifolius, 11206.
  luteus, 11207.
Lycopersicum esculentum, 12705, 12706, 12725, 12726, 13001.
Maba sandwicensis, 14424.
Macadamia ternifolia, 11797, 15697.
Magnolia pumila, 10968.
  stellata rosea, 13802.
Mahogany. See *Swietenia mahagoni*.
Malpe. See *Bidens heterophylla*.
Mammea americana, 11648.
Mammee apple. See *Mammea americana*.
Manfreda sp., 16159.
Mangifera cambodiana, 11645.
  indica, 10636 to 10669, 10960, 11369, 11625, 11766, 11779, 12240, 12241, 12305, 12930, 12931, 13338, 13348, 14448, 15424.
  mekongensis, 11646.
Mango (Africa), 11779.
  (Florida), 12138, 12240, 12241, 12305.
  (Hawaii), 11766, 12930, 12931.
  (India), 10636 to 10669, 11369, 13338, 13348, 15424.
  (Mexico), 14448.
  (Tahiti), 10960, 11625.
  See also *Magnifera indica*.
Mango ginger. See *Curcuma amada*.
Mangosteen. See *Garcinia mangostana*.
Manihot sp., 11698 to 11713.
Manila hemp. See *Musa textilis*.
Maple, broad-leaved. See *Acer macrophyllum*.
Maranta sp., 16764.
  amabilis, 16503.
  lineata rosea, 15677.
  splendida, 16765.
  wallisi, 16502.
Mariposa lily. See *Calochortus* sp.
Maritzgula. See *Carissa arduina*.
Martingula. See *Carissa arduina*.
Matondo, 13132.
Matricaria eximia, 13617.
Matundulaku, 12810, 12959.
Meconopsis integrifolia, 13340.
Medicago sp., 13809.
  cancellata, 13648.
  carstiensis, 14853.
  ciliaris, 16260.
  denticulata, 11208, 13552, 16771.
  echinus, 16261.
  elegans, 16262.
  gerardi, 16286.
  lupulina, 13742, 13751, 16138.
  maculata, 16213.
  media, 13488, 16399, 16400.
  minima, 16264.
  orbicularis, 10725, 16265.
  radiata, 16266.
  rigidula, 16286.
  sativa, 10232 to 10235, 11209 to 11211, 11275, 11651, 11652, 12231, 12398, 12409, 12549, 12671, 12694 to 12696, 12702, 12747, 12748, 12772, 12784, 12801, 12803, 12816, 12820, 12846, 12847, 12991, 12992, 13237, 13259, 13291, 13358, 13435 to 13440, 13478 to 13487, 13489, 13519 to 13521, 13541 to 13547, 13561, 13564, 13738, 13739, 13743 to 13745, 13653 to 13755, 13757 to 13759, 13767, 13769, 13778, 13857, 13858, 13999, 14496, 14497, 14883, 14886, 14962, 16136, 16209, 16317, 16401 to 16403, 16508.
    getula, 12803.
    × *falcata*, 16263.
  scutellata, 16267.
  terebellum, 16287.
  turbinata, 16288.
Melaleuca pustulata, 10510.
Melica californica, 16407.
Melilotus alba, 11212, 16135, 16289, 16489.
  altissima, 16268.
  elegans, 14854.
  indicus, 16404.
  italica, 16269.
  macrostachys, 16405.
  speciosa, 13559.
  sulcata, 13558, 14855, 16406.

Melilotus tommasini, 14856.
Melon. See *Cucumis* spp.
Mesembryanthemum sp., 12574 to 12576.
crystallinum, 10706, 10740.
geminatum, 13102.
Mesua ferrea, 11033.
Mezoneuron kauaiensis, 14425.
Microlaena stipoides, 15951.
Milla biflora, 16151.
Millet, German. See *Chaetochloa italica.*
Italian. See *Chaetochloa italica.*
broom-corn. See *Panicum miliaceum.*
pearl. See *Pennisetum typhoideum.*
See also *Chaetochloa italica.*
Milo maize. See *Andropogon sorghum.*
Miscanthus condensatus, 10524, 12156.
Monarda fistulosa, 12447.
punctata, 12448.
Monstera deliciosa, 15673.
Moraea iridioides, 13732.
Morning-glory (Japan), 10623, 13080 to 13083.
See also *Convolvulus* spp.
Morus alba, 12859.
Mucuna utilis, 11213, 11503.
Mulberry. See *Morus* spp.
Mung bean. See *Phaseolus max* and *Phaseolus radiatus.*
Musa sp., 11647, 15876 to 15879.
ensete, 14457.
sapientum, 10965, 13568.
textilis, 10405, 12708, 16214.
Mushroom. See *Agaricus* spp.
Muskmelon. See *Cucumis melo.*
Mustard, Russian, 10245 to 10247.
See also *Brassica* spp.
Myoporum deserti 10511.
sandwicensis, 14431.
Myosotis sp., 13610, 13715.
Myrobalan. See *Terminalia* sp.
Myrsine lassertiana, 14428.
Narcissus sp., 12263 to 12265, 12280 to 12302, 15667, 15703, 15705 to 15708, 15744, 15769, 15772, 15844, 15847.
barrii conspicuus, 15845.
bicolor, 15438, 15449, 15455, 15589, 15590, 15593, 15666, 15701.
horsfieldii, 15586, 15658. 15699.
biflorus, 15446.
incomparabilis, 15447, 15454, 15591, 15662, 15702.
pachybolbus, 13305.
poeticus, 15440, 15450, 15452.
alba, 14491.
ornatus, 15451, 15663, 15770.
pseudo-narcissus, 15423, 15435 to 15437, 15448, 15453, 15456, 15585, 15587, 15588, 15592, 15659 to 15661, 15664, 15700, 15704, 15709, 15767, 15768, 15771, 15773, 15846, 15848.
Narcissus tazetta alba, 15439, 15459, 15657, 15698, 15774.
Nectarine. See *Amygdalus persica.*
Nelumbium speciosum, 12157 to 12176.
Nephelium lappaceum, 13258, 13571, 13798.
litchi, 10670 to 10673, 11342, 14888, 16237 to 16243.
mutabile, 13799, 13861, 13988, 14815.
Nerine sp., 14789.
Nicotiana sanderae, 12139, 12358.
tabacum, 10451 to 10453, 11001, 11035 to 11038, 11497, 11498, 11999, 12000, 12105 to 12107, 12683, 12920, 14420, 14421, 14871 to 14878, 14975 to 14979, 16788.
Nuphar polysepalum, 11783.
Nut, Australian. See *Macadamia ternifolia.*
Oak, cork, 10264.
See also *Quercus* spp.
Oat, (Algeria), 10269.
(England), 10354 to 10359.
(Finland), 10271.
(Germany), 14802.
(New Zealand), 12877 to 12882.
(Norway), 13576, 13577.
(Russia), 10183 to 10193, 10321, 10624.
(Sweden), 10278, 10279.
Swedish Select, 10330, 10455.
(Transvaal), 13968.
See also *Avena sativa.*
Oenothera ovata, 15883.
rosea, 10707, 10741.
Olea europaea, 12569 to 12573, 12672 to 12677, 12684, 12685, 12753, 12754, 12910, 12921, 13257, 13567.
Olearia pimeloides, 10512.
Olive. See *Olea europaea.*
Onagraceae, 16199.
Onion. See *Allium cepa.*
Onobrychis onobrychis, 13794, 13991, 16246.
Opuntia sp., 14476, 14787, 14822 to 14839, 14923 to 14944, 14949 to 14951, 14980 to 14983, 15839 to 15843.
ficus-indica, 12837 to 12842, 13350, 14777, 14806 to 14810, 14816 to 14821, 15850.
gymnocarpa, 12112, 12402, 12403, 15777.
tomentosa, 12836.
Orange. See *Citrus aurantium.*
Orania philippinensis, 14472, 14814.
Orchidaceae, 11346, 13273.
Origanum vulgare, 12422, 12432.
Ornithopus sativus, 12407, 13990.
Oryza glutinosa, 13047 to 13054, 13069 to 13076, 16189.
sativa, 12130, 12453 to 12457, 12679, 12711 to 12715, 12759 to 12767, 12808, 12852, 12865 to 12871, 12874 to 12876, 13035 to 13076, 14779 to 14785, 14963, 14967, 15480 to 15583, 15759 to 15761, 15778, 15881, 16328.
utilissima, 13035 to 13046, 13055 to 13068.

Pachyrhizus sp., 12369.
Paeonia sp., 12028 to 12103, 16541 to 16659.
anomala, 16660.
moutan, 16663 to 16762.
tenuifolia, 16661, 16662.
Panax elegans, 11751.
gaudichaudii, 14423.
ginseng, 10326, 12443 to 12446.
Pancratium sp., 11002.
Pandanus luzonensis, 14473.
Panicum sp., 16408, 16409.
colonum, 13894.
crus-galli, 16410, 16411.
decompositum, 11727.
effusum, 14902.
isachne, 13913.
maximum, 11800, 12365, 12678, 13563, 14492, 14776.
miliaceum, 10625, 11495, 12016 to 12018, 14955, 14956, 14968, 16314, 16412 to 16423.
sanguinale, 14903.
sulcatum, 13922.
teneriffae, 13893.
Papaver sp., 10259, 11798.
bracteatum, 13677.
croceum, 13674, 13675.
nudicaule, 13633, 13649 to 13652.
orientale, 13634 to 13636, 13653 to 13656, 13658, 13676, 13724.
rhoeas, 12785.
somniferum, 12906, 12907, 12966 to 12970, 13107, 15822 to 15824.
×*P. bracteatum*, 11798.
Papaw. See *Carica papaya*.
Papyrus. See *Cyperus papyrus*.
Pardanthus chinensis. See *Belamcanda punctata*.
Parietaria arborea, 10708, 10742.
Parkinsonia sp., 15808.
Parota. See *Enterolobium cyclocarpum*.
Paspalum sp., 15362.
brevifolium, 14904.
digitatum, 16230.
Passiflora acerifolia, 11124.
alata, 11126.
coerulea, 11120.
edulis, 11121, 12899.
ligularis, 11125.
manicata, 11123.
pfordii, 11122.
Passion flower. See *Passiflora* spp.
Pea, field. See *Pisum arvense*.
(Finland), 10274.
flat. See *Lathyrus sylvestris*.
(New Zealand), 12887 to 12889.
Russian, 10238 to 10240.
sweet. See *Lathyrus odoratus*.
Tangier scarlet. See *Lathyrus tingitanus*.
Tibetan, 15750.
See also *Pisum* spp.
Peach (Arabia), 10457.
(Central Asia), 10335 to 10337.
(China), 15753, 15754, 15935.
See also *Amygdalus persica*.
Peanut (Australia), 16233 to 16236.
(Brazil), 11532.
(China), 14961, 14962.
(France), 15782 to 15787, 16161.
(Italy), 16162 to 16164.
(Japan), 10622.
(Natal), 16472.
See also *Arachis hypogaea*.
Pear. See *Pyrus* sp.
Pecan. See *Hicoria pecan*.
Pennisetum macrophyllum atrosanguineum, 13646.
typhoideum, 11214, 12851, 16424.
Pentstemon sp., 13696.
hyb., 13678, 13679.
Pentzia virgata, 10635, 11740.
Pepino. See *Solanum muricatum*.
Pepper, chili, 11639, 14484.
Japanese. See *Xanthoxylum piperitum*.
paprika, 10392, 10755, 10756, 11741, 11742.
red, 10393 to 10395.
sweet, 10396, 14485.
See also *Capsicum* spp.
Perilla ocymoides, 10632.
Periploca laevigata, 10709, 10743.
Persea carolinensis, 11765.
gratissima, 10615 to 10620, 10978, 11724, 12933 to 12937, 13292, 13729 to 13731, 14435, 14463, 14889 to 14890, 15656, 16170.
indica, 14498, 16133, 16169.
Persimmon, Japanese. See *Diospyros kaki*.
Petroselinum sativum, 12721.
Phalaris arundinacea, 13951, 16425.
canariensis, 13300 to 13303, 13586, 13947 to 13950, 16426 to 16432.
Phaseolus sp., 13392, 13393, 16791.
angularis, 10523, 13384 to 13391, 13405.
caffer, 16290.
calcaratus, 13380 to 13383.
lunatus, 12730, 14974.
max, 13400 to 13403, 16129.
multiflorus, 16302.
radiatus, 10284, 10329, 10407, 10527, 10610, 11098, 12775, 13394 to 13399, 14960, 15926, 16210, 16211, 16323, 16793.
retusus, 13404.
vulgaris, 10353, 11055 to 11057, 12736, 12743, 12817, 12818.
Philadelphus lemoinei, 16513.
Phleum alpinum, 10548.
medium, 10547.
michelii, 10549, 14846.
pratense, 10282, 10456, 10458 to 10461, 10545, 10546, 10550, 10578, 10589, 10621, 10726, 11000, 11215, 11494, 12234, 12894, 13580, 15669, 16433 to 16435.
Phlox decussata, 13680, 13681, 16514 to 16540.

Phlox drummondii, 12965.
Phoenix dactylifera, 10757 to 10958, 11003, 11128, 11277 to 11341, 11485 to 11489, 11801 to 11996, 15000 to 15314.
Phyllostachys henonis, 12177.
  mitis, 12178.
  nigra, 12179.
  quilioi, 12180.
Physalis sp., 12395, 12396, 15745, 15931.
  edulis, 14908.
Picrasma ailanthoides, 12861.
Pimbe, 12811, 12960.
Pimpinella anisum, 12388, 12701.
Pineapple. See *Ananas sativus*.
Pinguicula sp., 12995, 14998.
  caudata, 12996.
Pinus canariensis, 10710.
  parviflora, 15928.
Piper nigrum, 15681.
Pistache. See *Pistacia vera*.
Pistacia sp., 13154.
  atlantica, 10267, 10288, 10328.
  chinensis, 10285.
  mutica, 10265, 10266, 10287, 10377.
  terebinthus, 10268, 10286, 10322, 12232.
  vera, 10323, 10376, 11778, 12243, 12746, 12782, 12783, 12815, 12835, 12848, 12922 to 12924, 13569.
Pisum sp., 10986, 11097, 11111, 11112, 15750, 16326.
  arvense, 11216, 13992, 16130, 16436, 16437.
  elatius, 16301.
  jomardi, 16291.
  sativum, 10238 to 10240, 10274, 10987, 12392, 12698, 12722, 12723, 12731, 12887 to 12889, 13579.
Pittosporum buchanani, 11752.
  macrophyllum, 11644.
  undulatum, 11753.
Plantago fastigiata, 16438, 16439.
Plocama pendula, 10711.
Plum, Russian, 10262, 10263.
  Turkish, 10526, 13157.
  wild African, 12751, 13139, 13141.
  See also *Prunus* spp.
Poa attica, 14847.
  mulalensis, 10977.
  pratensis, 11217, 11737, 12550, 16228.
  triflora, 16440.
Podocarpus elata, 15694.
Podolepis acuminata, 10513.
Polianthes elongata, 11260.
  longiflora, 11533.
  tuberosa, 14811.
Polygonum baldschuanicum, 13599.
  monspeliensis, 13664.
Polypteris texana, 16160.
Pomegranate. See *Punica granatum*.
Pomelo. See *Citrus decumana*.
Popcorn, (Brazil), 13260 to 13262.
  (Chile), 14909 to 14921.
  (Dutch East Indies), 14992.
  (India), 13354.
  See also *Zea mays*.
Poppy, California. See *Eschscholtzia californica*.
  Tibetan. See *Meconopsis integrifolia*.
  See also *Papaver* spp.
Portulacaria afra, 12020.
Potato, American, 10570, 14800.
  aquatic, or "Mercedes." See *Solanum commersoni*.
  (Ecuador), 14893 to 14895, 14973, 16248 to 16253.
  (England), 12608 to 12613, 12643 to 12668.
  (France), 12602 to 12607.
  (Germany), 12578 to 12596.
  (Holland), 12597 to 12601.
  (Scotland), 12614 to 12649, 13027 to 13034, 14490.
  sweet. See *Ipomoea batatas*.
  wild, 10473.
  See also *Solanum tuberosum*.
Poterium sanguisorba, 12577.
Primula sp., 13613.
Proso. See *Panicum miliaceum*.
Prostanthera striatifolia, 10514.
Prunus sp., 10260, 11020, 11636, 14434, 15810.
  armeniaca, 11633.
  cerasus, 10580 to 10582, 11034.
  divaricata, 10262, 10263.
  domestica, 10526, 13157.
  paniculata, 12181 to 12230.
  pseudo-cerasus. See *Prunus paniculata*.
  sibirica, 14487.
  virginiana, 11499, 11500.
Psidium sp., 10464.
  guajava, 11726, 13806.
  molle 11004, 11005, 12716, 12821.
Psoralea bituminosa, 10712.
Pumpkin. See *Cucurbita pepo*.
Punica granatum, 10368 to 10370, 12566 to 12568, 12925, 12998, 12999, 13298.
Pyrethrum cinerarifolium, 12416, 12435.
  roseum, 12415, 12434.
Pyrus sp., 15375.
  malus, 10261, 10345 to 10348, 10525, 13087, 13156.
Quercus cornea, 10633.
  cuspidata, 13997.
  suber, 10264.
Quince. See *Cydonia* sp.
Radish. See *Raphanus* spp.
Rambutan. See *Nephelium lappaceum*.
Ranunculus canariensis, 10713.
Rape, Italian, 13733.
  Russian, 10243, 10244.
  See also *Brassica napus*.
Raphanus sp., 15321 to 15332, 15814, 15815.
  sativus, 10397, 10399, 10990, 12707, 12724, 12919.
Raspberry. See *Rubus* spp.
Rauwolfia sandwicensis, 14422.
Red bay. See *Persea carolinensis*.
Rhamnus alaternus calabrica, 12858.
  crenulata, 10714.
  purshiana, 12734.
Rheum officinale, 13089.

- *Rheum palmatum tanghuiticum*, 13093.
- *Rhodocystus berthelotianus*, 10715, 10744.
- Rhubarb. See *Rheum* spp.
- *Rhus* sp., 13155.
- *Ribes grossularia*, 10250.
- Rice (Brazil), 12522.
  - (British Guiana), 12489 to 12512.
  - (Ceylon), 12464 to 12478, 12808.
  - (China), 12874 to 12876, 16189, 16328.
  - (Dutch East Indies), 15778.
  - (Egypt), 12513 to 12515.
  - (Formosa), 13035 to 13076.
  - (France), 12453 to 12463.
  - (German East Africa), 12523, 12524, 15480 to 15583.
  - (Greece), 12521.
  - (India), 12130, 12865 to 12871, 14779 to 14785, 14967.
  - (Italy), 12519, 12520.
  - (Japan), 12679, 12711 to 12715, 12761 to 12765, 14963, 15759 to 15761.
  - (Java), 12525 to 12547, 12759, 12760.
  - (Korea), 12766, 12767.
  - (Siam), 12516 to 12518.
  - (Singapore), 12479 to 12488.
  - wild. See *Zizania aquatica*.
  - See also *Oryza sativa*.
- *Ricinus* sp., 11068 to 11073, 11638.
  - *zanzibariensis*, 12856.
- *Rosa* sp., 11517 to 11531, 11536 to 11538, 13116 to 13120, 13243 to 13255, 13320 to 13337, 15425, 15426.
  - *humilis*, 11519.
  - *rugosa*, 12915.
    - hyb., 13108 to 13115, 13121 to 13129.
- Roselle. See *Hibiscus sabdariffa*.
- *Rosmarinus officinalis*, 12418, 12438.
- Rubber. See *Castilla* spp. and *Landolphia* sp.
- *Rubia fruticosa*, 10716, 10745.
- *Rubus* sp., 15376.
  - *australis*, 11505.
  - *biflorus*, 11506.
  - *deliciosus*, 11512.
  - hyb., 11516.
  - *leucodermis*, 11513.
  - *nigrobaccus*, 11510, 11515.
  - *occidentalis*, 11514.
  - *odoratus*, 11507.
  - *phoenicolasius*, 11509.
  - *rosaefolius*, 11508.
  - *spectabilis*, 11511, 15427.
  - *villosus*, 11515.
- *Rudbeckia fulgida variabilis*, 13663.
  - *speciosa bicolor*, 13704.
- *Rumex lunaria*, 10717.
- Rush. See *Juncus* spp.
- Rye, Abruzzes, 10366.
  - (Finland), 10273.
  - German, 11735.
  - Russian, 10168 to 10182, 10320.
  - Swedish, 10280.
  - Winter Ivanof, 10367.
  - See also *Secale cereale*.
- *Saccharum officinarum*, 12739 to 12742, 12786 to 12789.
- Safflower. See *Carthamus tinctorius*.
- Sage. See *Salvia officinalis*.
- Sainfoin. See *Onobrychis onobrychis*.
- *Salix* sp., 12914, 12916.
  - *alba argentea*, 12347.
    - *britzensis*, 12318.
    - *vitellina*, 12324.
      - *aurantiaca*, 12334.
      - *flava*, 12320.
      - *nova*, 12356.
  - *ambigua*, 12337.
  - *argentea auritea*, 12315.
  - *babylonica*, 12344.
  - *bataviae*, 12317.
  - *bicolor laureana*, 12332.
  - *blanda* (*S. babylonica* × *fragilis*), 12331.
  - *caesia pendula zabeli*, 12307.
  - *casiandra lancifolia*, 12312.
  - *cinerea repens*, 12345.
    - *tricolor*, 12336.
  - *cordata vestita*, 12355.
  - *daphnoides femina*, 12321.
    - *mascula*, 12330.
    - *pomerania femina*, 12309.
  - *decipiens*, 12333.
  - *erdingeri*, 12325.
  - *fragilis ammaniana*, 12346.
    - *basfordiana*, 12313.
  - *hippophaifolia undulata*, 12353.
  - *laurina*, 12343.
  - *longifolia*, 12342.
  - *mollissima*, 12351.
  - *nigricans*, 12350.
    - *ansoniana*, 12326.
    - *cotinifolia*, 12319.
    - *menthifolia*, 12348.
    - *moabitica*, 12316.
    - *prunifolia*, 12308.
    - *viburnoides*, 12357.
  - *pellita*, 12340.
  - *petiolaris*, 12322.
  - *purpurea lambertiana*, 12335.
    - *scharfenbergensis*, 12311.
    - *urabensis*, 12327.
  - *repens argentea*, 12341.
  - *rosmarinifolia*, 12349.
  - *rubra forbyana*, 12314.
  - *seringeana*, 12323.
  - *smithiana acuminata* (*S. dasyclados*), 12339.
  - *spaethi*, 12354.
  - *triandra* (*S. lappeana*), 12310.
  - *undulata*, 12328.
  - *viminalis*, 12329.
    - *superba*, 12352.
  - *voronesh*, 12338.
- Salmon-berry. See *Rubus* spp.
- Saltbush. See *Atriplex* spp.
- *Salvia argentea*, 13686.
  - *carduacea*, 13687.
  - *coccinea*, 13688.
  - *officinalis*, 12423.
- *Sansevieria cylindrica*, 15675.
- *Sanvitalia procumbens*, 12864.
- *Sapindus utilis*, 13304.
- *Sapium sebiferum*, 11795.

Sapodilla. See *Achras sapota.*
Sapote blanco. See *Cussimiroa edulis.*
Satureja hortensis, 12419, 12439, 12905.
Schoenocaulon sp., 14996.
officinale, 14486, 15828.
Scirpus triqueter, 13265.
Scitamineae, 12551.
Sclerolaena bicornis, 10517.
Scotch broom. See *Citisus scoparius.*
Scurvy grass. See *Cochlearia officinalis.*
Secale cereale, 10168 to 10182, 10273, 10280, 10320, 10366, 10367, 11218, 11219, 11268, 11735, 11760, 12855, 15800, 15868, 15869.
Sechium edule, 10959, 12024, 12025, 12115, 12304, 12366, 12737, 12909, 13084.
Sempervivum tabulaeformae, 10718.
Senna. See *Cassia angustifolia.*
Sequoia gigantea, 11997.
Serradella. See *Ornithopus sativus.*
Sesame. See *Sesamum indicum.*
Sesamum indicum, 12387, 14958, 14959, 16311.
Sesbania macrocarpa, 11781.
tripetii, 12857.
Setaria sp., 15341.
aurea, 15344.
italica. See *Chaetochloa italica.*
sulcata, 15366.
Shasta daisy. See *Chrysanthemum leucanthemum* hyb.
Sicana odorifera, 11720.
Sideritis massoniana, 12860.
Silene armeria, 13689, 13690.
orientalis, 13615.
pendula, 13691 to 13693.
Smilax medica, 15674.
sandwicensis, 10314.
Soapberry. See *Sapindus utilis.*
Solanum sp., 11272.
commersoni, 10324, 12113, 13105, 14475.
jamesii, 10473.
muricatum, 14891.
tuberosum, 10570, 12578 to 12668, 13027 to 13034, 14490, 14800, 14893 to 14895, 14973, 16284 to 16253.
Sorbus domestica, 10349 to 10351.
Sorghum (Africa), 10327, 11793.
(Central Asia), 10612.
(India), 14500 to 14775.
See also *Andropogon sorghum.*
Sorghum halepense. See *Andropogon halepensis.*
vulgare. See *Andropogon sorghum.*
Sow-itk. See *Carum gairdneri.*
Sparaxis bulbifera, 14986.
purpurea, 14987.
Spartina sp., 16441.
cynosuroides, 16442.
Spergula arvensis, 12406.
Spikenard. See *Aralia racemosa.*
Spinach, New Zealand. See *Tetragonia expansa.*
Spondias purpurea, 11006, 11007.
Sporobolus lindleyi, 10516.
Sprekelia, 16149.
Sprekelia formosissima, 12997.
Spurry. See *Spergula arvensis.*
Squash. See *Cucurbita* spp.
Stachys sieboldii, 10634.
Statice brassicaefolia, 10719.
pectinata, 10720, 10746.
Sterculia acerifolia, 11754, 15695.
diversifolia, 11755, 14900.
Stipa tenacissima, 13860, 16443.
tuckeri, 14906.
Strawberry. See *Fragaria* sp.
Stuartia pentagyna, 13299.
pseudo-camellia, 13998.
Sugar cane. See *Saccharum officinarum.*
Sulla. See *Hedysarum coronarium.*
Sumac. See *Rhus* sp.
Sunflower, Russian, 10223 to 10225.
See also *Helianthus annuus.*
Swainsona maccullochiana, 15954, 16140.
Sweet fennel. See *Foeniculum dulce.*
Swietenia mahagoni, 10409.
Syncarpia laurifolia, 11756.
Synnotia bicolor, 14988.
Tacca pinnatifida, 10313, 15838.
Tacsonia exoniensis, 11127.
Tagasaste. See *Cytisus proliferus albus.*
Tagetes sp., 12978.
Talinum sp., 16158.
Tallow tree. See *Sapium sebiferum.*
Tamarind. See *Tamarindus indica.*
Tamarindus indica, 15880.
Tamus edulis, 10721, 10747.
Tangelo. See *Citrus* hyb.
Taro. See *Colocasia* sp.
Tecoma capensis, 16232.
Telopia speciosissima, 15696.
Teosinte. See *Euchlaena mexicana.*
Terebinth. See *Pistacia terebinthus.*
Terminalia sp., 12553 to 12556.
Tetragonia expansa, 12779.
Teucrium hyssopifolium, 10722, 10748.
Themeda ciliata. See *Anthistiria ciliata.*
Theobroma cacao, 11656, 15747 to 15749.
Thevetia sp., 11691.
cuneifolia, 11626, 11627, 11799.
ovata, 11659.
Thuja gigantea, 12237.
Thymus vulgaris, 12417, 12437.
Thysanolaena agrostis, 11739, 14922.
Tijocate. See *Crataegus* sp.
Timothy. See *Phleum pratense.*
Tobacco (Brazil), 11001, 11035 to 11038, 11498, 12105 to 12107, 14420, 14421, 14871, 14878, 14975 to 14979, 16788.
Cuban, 10452, 10453.
flowering, 12139, 12358.
(Turkey), 11497.
See also *Nicotiana tabacum.*
Tomato. See *Lycopersicum esculentum.*
Tree cotton. See *Gossypium arboreum.*
tomato. See *Cyphomandra betacea.*
Trefoil, bird's-foot. See *Lotus corniculatus.*
yellow. See *Medicago lupulina.*
Trichinium alopecuroideum, 10518.
exaltatum, 10520.
nobile, 10521.

Trichinium obovatum, 10519.
Tricholaena rosea, 13893.
Trifolium sp., 10254, 10566, 13810.
  alexandrinum, 10373, 10374, 11221, 11782, 12132, 13500, 13528.
  alpestre, 14857.
  badium, 14858.
  filiforme, 13532.
  fragiferum, 13533.
  hybridum, 10567, 11019, 11222, 13501, 13510, 13534, 13535, 13551, 13765, 13775.
  incarnatum, 11223, 13491 to 13494, 13497, 13537 to 13540, 13764, 14466, 14494, 14994, 15476, 15477.
  johnstoni, 10352.
  longipes, 13560.
  lupinaster, 10565.
  maritimum, 12927.
  montanum, 14859.
  ochroleucum, 14860.
  pannonicum, 13536, 16444.
  polystachyum, 12928.
  pratense, 10532 to 10534, 10563, 10564, 10577, 10626, 10627, 11018, 11224, 12891, 13490, 13495, 13496, 13498, 13499, 13506 to 13509, 13513, 13515 to 13517, 13522 to 13527, 13548, 13549, 13581, 13734 to 13737, 13740, 13741, 13746 to 13749, 13752, 13756, 13760, 13761, 13763, 13766, 13770 to 13772, 13774, 13776, 14493, 16445.
    perenne, 13772.
  procumbens, 12929.
  repens, 11225, 11276, 12890, 13511, 13512, 13518, 13529 to 13531, 13550, 13773, 13777, 13853, 14495.
    perenne, 13773.
  rubens, 14861.
Trigonella coerulea, 16270.
  corniculata, 16271.
  foenum-graecum, 10993, 11087, 11088, 16335, 16446.
Tristania laurina, 11757.
Triticum sp., 11049 to 11054, 11731, 12377.
  boeoticum, 16292.
    thaoudar, 16293.
  cristatum, 14848.
  dasyanthum, 14849.
  desertorum, 14850.
  dicoccum, 11094, 11650, 12379, 12853, 16294.
  durum, 10364, 10391, 10454, 11039, 11099, 11618, 11619, 11715, 13854 to 13856, 15788.
  giganteum, 16295.
  intermedium, 14851.
  (mixt), 10385 to 10389.
Triticum monococcum, 10474, 15853 to 15855, 16296.
    hornemanni, 16297.
  polonicum, 10611, 16298.
  rigidum, 16272, 16299.
  spelta, 15865.
  trichophorum, 16273.
  violaceum, 14852, 16347.
  vulgare, 10194 to 10218, 10272, 10277, 10318, 10319, 10382 to 10384, 10390, 10552, 10992, 11226 to 11229, 11266, 11603 to 11623, 11714, 12001 to 12015, 12134, 12883, 12884, 13973 to 13975, 14803, 14970, 15801, 15802, 15870 to 15874, 16327.
Tritonia fenestrata, 14989.
Trixago versicolor, 10749.
Tuberose. See *Polianthes* spp.
Tulipa sp., 12258 to 12262, 12266 to 12279, 14419, 15443 to 15445, 15710 to 15738, 15905 to 15925.
  armena, 15596.
  australis, 15597.
  aximensis, 15598.
  batalini, 15599.
  biebersteiniana, 15600.
  biflora, 15601.
  billietiana, 15602.
  clusiana, 15603.
  dasystemon, 15604.
  didieri, 15605.
    alba, 15606.
    lutescens, 15607.
  eichleri, 15608.
  fragrans, 15609.
  galatica, 15610.
  greigi, 15611.
    aurea, 15612.
  hageri, 15613.
  ingens, 15614.
  kaufmanniana, 15615.
    aurea, 15616.
    coccinea, 15617.
  kolpakowskyana, 15618.
    splendens, 15619.
  linifolia, 15620.
  lownei, 15621.
  maculata, 15622.
  marjolleti, 15623.
  mauriana, 15624.
  micheliana, 15625.
  montana, 15626.
  oculus solis, 15627.
  orphanidesi, 15628.
  ostrowskyana, 15629.
    crocea, 15630.
  patens, 15631.
  persica, 15632.
  planifolia, 15633.
  praecox, 15634.
  praestans, 15635, 15636.
  primulina, 15637.
  pulchella, 15638.
  saxatilis, 15639.
  sprengeri, 15640.
  stellata, 15641.
  strangulata, 15642.

Tulipa sylvestris, 15643.
  triphylla, 15644.
  tubergeniana, 15595.
  wilsoniana, 15645.
Tuna. See *Opuntia* spp.
Turmeric. See *Curcuma longa*.
Turpentine tree. See *Pistacia mutica*.
Udo, kan. See *Aralia cordata*.
  moyashi. See *Aralia cordata*.
Ulex europaeus, 11758, 12408, 12670, 13241.
Vanilla sp., 14440, 14443 to 14446.
  planifolia, 14441, 14442.
Verbascum phoeniceum, 13618.
Verbena bonariensis, 10723, 10750.
Veronica spicata, 13611.
Vetch, common. See *Vicia sativa*.
  hairy. See *Vicia villosa*.
  Japan. See *Vicia hirsuta*.
  pearl. See *Vicia sativa alba*.
  wild Russian, 10256 to 10258.
  See also *Vicia* spp. and *Lathyrus* spp.
Viburnum dilatatum, 13996.
Vicia sp., 10256 to 10258, 13406 to 13409, 13582, 16192, 16447 to 16451.
  altissima, 14862.
  angustifolia, 13796.
  atropurpurea, 12135, 16452.
  bithynica, 11230, 16453.
  calcarata, 14863.
  cornigera, 16274.
  cracca, 10283, 16454, 16455.
  dasycarpa, 14864.
  disperma, 14865.
  dumetorum, 14866, 16275.
  egyptica, 16456.
  ervilia, 13410.
  faba, 10406, 10411 to 10448, 10535 to 10543, 10724, 10753, 10962, 10991, 11102, 11103, 11697, 11759, 11998, 13411, 13779 to 13785, 14468, 14880, 14881, 15428, 15429, 16457.
  fulgens, 11231, 16458.
  gigantea, 16459.
  grandiflora, 14867.
  hirsuta, 16460.
  hirta, 16461.
  lutea, 16462.
  micrantha, 16463.
  narbonnensis, 11232, 16464.
  pisiformis, 14868.
  sativa, 11233, 11679, 11738, 11764, 11791, 13356, 13412 to 13431, 16466.
    alba, 16465, 16467, 16488.
  sicula, 16468, 16469.
  urvuga, 13432.
  villosa, 11234, 11235, 11677, 11680, 11763, 13433, 14467, 14990, 16191, 16470.
Vigna glabra, 16300.
  sesquipedalis, 16794.
  sinensis, 11074 to 11076, 11090, 11091, 11236, 11344, 11370, 13454 to 13477, 14474, 14499, 16166 to 16168, 16229, 16303, 16795.
Vitis sp., 11372 to 11477, 11492, 11493, 12940 to 12957, 13133.
Vitis coignetiae, 11674.
  gongylodes, 11491.
  rhombifolia, 11490.
  vinifera, 10289 to 10308, 10331 to 10334, 10340 to 10342, 10598 to 10609.
Voandzeia subterranea, 10450, 16473.
Walnut hyb., 10587.
  See also *Juglans* spp.
Wasabi, dry land. See *Eutrema hederaefolia*.
Water lily. See *Nuphar polysepalum*.
Watermelon. See *Citrullus vulgaris*.
Wattle. See *Acacia* spp.
Wheat (Alaska), 10552.
  (Central Asia), 10611, 16327.
  (Egypt), 10382 to 10391.
  (Finland), 10272.
  (Germany), 11731, 14803.
  (India), 14970.
  (New Zealand), 12883 to 12886.
  (Russia), 10194 to 10218, 10318, 10319.
  (Sweden), 10277.
  See also *Triticum* spp.
Whin, See *Ulex europaeus*.
Willow. See *Salix* spp.
Wineberry. See *Rubus* spp.
Woandzu. See *Voandzeia subterranea*.
Wood oil. See *Aleurites cordata*.
Xanthosoma sp., 10594 to 10597, 15377, 15379, 15380, 15383 to 15392, 15394, 15397 to 15401, 15403 to 15412, 15414 to 15421, 15791, 15792, 15803, 16139, 16226, 16778.
  lindeni, 15682, 16496.
  maculatum, 15790.
  robustum, 15793.
  sagittifolium, 13085, 14471, 15417, 15804, 16225.
  violaceum, 15794, 16779.
Xanthoxylum piperitum, 12131.
Yam (Hawaii), 10311 to 10314.
  (Porto Rico), 10590 to 10597.
  See also *Dioscorea* spp. and *Smilax sandwicensis*.
Yang-taw. See *Actinidia* sp.
Yautia. See *Xanthosoma* spp.
Yei-hap. See *Magnolia pumila*.
Yucca sp., 16197.
Zea mays, 10400, 10401, 11106, 12026, 12027, 12383, 12384, 12557 to 12563, 12697, 12939, 13143 to 13153, 13256, 13260 to 13262, 13354, 13357, 13570, 13970 to 13972, 14459, 14465, 14791 to 14798, 14909 to 14921, 14971, 14992, 15775, 16190, 16330, 16770, 16772, 16781 to 16784.
Zephyranthes, 14897, 16150, 16204.
Zingiber officinale, 11086.
Zinnia elegans, 12397, 12982 to 12985.
Zizania aquatica, 16165.
Zizyphus sp., 14882.
  jujuba, 12926.

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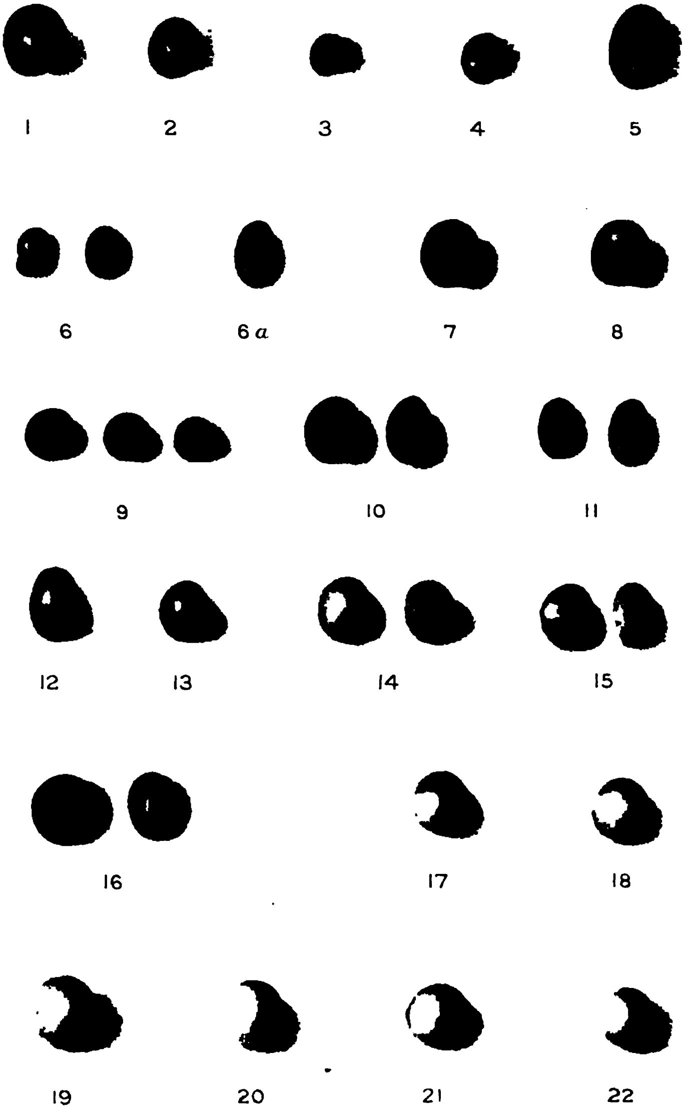

D. G. Passmore

SOY BEAN VARIETIES.

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LETTER OF TRANSMITTAL

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., December 14, 1906.

Sir: I have the honor to transmit herewith and to recommend for publication as Bulletin No. 98 of the series of this Bureau the accompanying manuscript, entitled "Soy Bean Varieties."

This paper was prepared by Mr. Carleton R. Ball, now Agronomist in the Grain Investigations of this Bureau, as the result of four years' investigations under the direction of the Agrostologist.

Soy beans have become an important crop in only a few localities in the United States, but in cases where farmers have learned how to utilize them to best advantage they have proved to be a crop of high value. They are especially valuable for mixing with corn for silage, for the production of hay, and for use as pasture, especially for hogs. They possess an advantage over cowpeas in that the growth is erect, and they are therefore easily harvested. Some of the taller sorts may be harvested with an ordinary grain binder.

One reason why soy beans have not become more prominent in American agriculture has been the impossibility of securing seeds of a particular variety. In this bulletin Mr. Ball has given an accurate description of each of the varieties, and where a suitable name has not already been attached to a variety a name is suggested. It is hoped that these varieties may pass into the trade under the names given in this bulletin, so that in the future farmers may be able to obtain from seedsmen the particular kind of soy bean which they wish to plant.

Respectfully,

B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

CONTENTS.

Page.
Origin and introduction of the soy bean........ 7
Variability........ 8
Classification........ 9
  Key to the varieties........ 11
Descriptions of the varieties........ 12

Black-seeded group:

    Buckshot........ 12
    Nuttall........ 14
    Kingston........ 15
    Ebony........ 15
    Flat King........ 16
    Riceland........ 16

Brown-seeded group:

    Ogemaw........ 17
    Eda........ 18
    Baird........ 18
    Brownie........ 19

Mottled-seeded group:

    Hankow........ 19
    Meyer........ 20

Green-seeded group:

    Samarow........ 20
    Guelph........ 20

Greenish-yellow-seeded group:

    Yosho........ 21
    Haberlandt........ 22
    Tokyo........ 22

Yellow-seeded group:

    Ito San........ 23
    Manhattan........ 24
    Butterball........ 24
    Amherst........ 25
    Hollybrook........ 25
    Mammoth........ 26
List of synonyms........ 27
Distribution numbers........ 27
Description of plates........ 30

ILLUSTRATIONS.

PLATES.

Page.

PLATE I. Seeds of all varieties of soy beans, in natural sizes and colors.. Frontispiece.

II. Seeds and pods of the black-seeded group.......................... 30

III. Seeds and pods of the brown-seeded and mottled-seeded groups..... 30

IV. Seeds and pods of the green-seeded and greenish-yellow-seeded groups.. 30

V. Seeds and pods of the yellow-seeded group.......................... 30

TEXT FIGURES.

FIG. 1. Diagram showing the probable relationships of the different groups of soy beans.. 10

2. Diagram showing for each variety of soy bean the number of days required to reach maturity and the height of the plant in inches. 13

B. P. I.—237.

SOY BEAN VARIETIES.

ORIGIN AND INTRODUCTION OF THE SOY BEAN.

The soy bean (*Glycine hispida* (Moench.) Maxim.) is an annual leguminous plant from the Orient. Its native home is said to be from southern Japan southward through eastern China and Indo-China to Java. In China and Japan it has been in cultivation for many centuries, certainly since before the beginning of the Christian era. In those countries it is easily the most important legume grown, and in some provinces it is the most important of all crops. Owing, perhaps, to the almost complete isolation of that part of the Orient, its cultivation spread only slowly to other lands. It is now grown to some extent in India, but its introduction there seems to be of recent date. It reached Europe probably in the latter part of the eighteenth century, and its arrival in England is credited to 1790. For several decades it was grown merely as a curiosity in botanic and private gardens. Investigation of the economic value of this plant began more than thirty years ago in Europe, rather earlier than in this country, but the soy bean has not yet attained any great prominence there.

The soy bean has been known in the United States for more than three-quarters of a century. In the New England Farmer of October 22, 1829, Thomas Nuttall wrote of its possibilities as a crop for this country. For many years it was grown only in gardens as a curious plant from the Far East. The Perry expedition to Japan in 1853 brought back two varieties, a yellow and a red sort, which were tested here in a limited way.

During the last twenty years the soy bean has been the subject of many experiments to determine its agricultural value and adaptations. The agricultural experiment stations of Kansas and Massachusetts were pioneers in these investigations and seed was imported directly from Japan by both stations. Through these efforts considerable interest was aroused, and two or three varieties soon became available commercially. The number of forms and varieties in this country was further increased by additional importations made by enterprising seedsmen. Since 1898 the Office of Seed and Plant

Introduction of the United States Department of Agriculture has secured from seven different countries of the old world no less than 65 different lots of soy bean seeds, representing about twenty varieties.

Other experiment stations and some seedsmen and private investigators have also been at work on this crop, and the number of real or supposed varieties has increased very rapidly in this country during the past few years. This general introduction of a new and little-known crop naturally resulted in much confusion concerning the names and characters of the different varieties. In many cases disappointment and loss have been caused to the grower by the lack of this information, and a really valuable crop has been brought into disfavor in some localities.

It is the purpose of this paper to describe and classify all obtainable varieties in such a way as to make them and their adaptations recognizable to farmers, seedsmen, and agricultural experimenters.

VARIABILITY.

The varieties described in the following pages are, of course, not botanical varieties, but agricultural forms, differing in color and size of seeds, in height and habit of plant, and in earliness and lateness of maturing. All these characters, except the color of the seed, vary greatly with the climate and soil. The variation between the products of two different years at the same place is frequently very striking. Every agricultural worker is familiar with the phenomena resulting from sowing southern-grown seed of various crops in the North, and vice versa. In the case of the soy bean, observation shows that the plant reaches a state of equilibrium usually in the second generation, and almost certainly in the third generation.

In the case of imported seeds, where the habit of the parent plant and the conditions under which it grew are generally unknown, it is naturally difficult to tell when equilibrium has been reached. It is certain that many of these imported forms are much smaller in size and of earlier maturity the first year in this country than they are the second year. Some have been discarded at experiment stations after one year of trial as "too dwarf to have any value here," when subsequent trial has shown them to be decidedly large and prolific. Some have not shown their true value until the third year, and perhaps not wholly even then. In some of these importations the variation year by year has been so striking as to arouse a suspicion that the plants are not the same as those of the preceding crop. Such, for example, is Agrostology No. 1299 (see Hollybrook), a yellow soy received from France and first grown in 1902. In that year it reached a height of 12 to 16 inches and ripened in ninety-five days, being classed as a "dwarf early yellow." In 1903 it reached 24 to 28 inches in height and required one hundred and twenty days to reach maturity, and was therefore called a "medium yellow." In 1905 the average height was 30 to 36 inches and one hundred and thirty to one hundred and forty days were needed to reach the mature condition, thus placing it with the "medium late yellow" variety Hollybrook, where it remains. While this is the most extreme case recorded, those somewhat less extreme are quite common.

Considerable variation is frequently noticed in the size of the seeds of a given variety. As might be supposed, the pods and seeds produced on plants dwarfed by drought, thick planting, etc., are generally smaller than those produced on normal plants. In a given season the average size of the seeds may be markedly different from that of the preceding or succeeding season. The seeds from pods produced late in the season are very likely to be noticeably reduced in size.

Most of the different numbers listed under the varieties described have been grown for three years, exclusive of the very unfavorable season of 1904. Some later arrivals have been studied but two years. Bearing in mind, therefore, the range of variation which may be expected and the causes which incite it, the writer can scarcely hope that no errors of classification have been made. He can only trust that whoever pursues this subject far enough to prove such errors will be in a position to understand and overlook them.

The facts stated will explain why such wide range is given in the tables and the descriptions to the average height and the average time required by any variety to reach maturity. Neither the minimum nor the maximum extreme is given in most cases, but rather the limits observed under fairly favorable circumstances. In the region lying between latitude 37° and 43° north and east of the ninety-seventh meridian (the west line of Minnesota and Indian Territory) soy beans are at their best in this country. There they are finding their most prominent and useful place in the agricultural system. In the Gulf region and on the Plains their height is likely to be much reduced, although the seed yield may not be impaired. The reduction in size is often accompanied by earlier maturity. In the Northern States the height reached may be even greater than that specified, but the seed yields are likely to be small and the growing period prolonged, at least until our varieties are more completely acclimated in those States.

CLASSIFICATION.

The first separation of the numerous forms or agricultural varieties of this species will naturally be through the colors of the seeds. The varieties having seeds of the solid colors black and yellow are by far the most numerous and the most striking. The greens and browns are much less common and are also very variable i shade. The browns are of various shades of reddish brown and a also closely related to the mottled group. The yellows vary com monly into greenish shades, and any line drawn between the yello and greenish yellow is only arbitrary. The yellows also vary in paler shades, and some have even been called "white" in Japa This is most noticeable in old seeds, but is never carried farther th a pale yellow. It seems likely that none of the legumes common cultivated in Japan can have pure white seeds, like our navy bea for example, or the term "white" would never be applied to a pal yellow form. All yellow soy beans turn gradually paler with age for least three or four years, although some varieties are originally pal than others. Although the black group shows more variation i

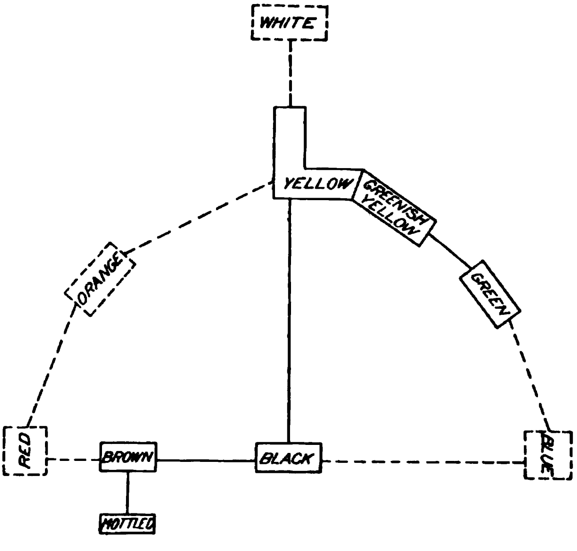

FIG. 1.—Diagram showing the probable relationships of the different groups of soy beans.

the size of the seeds, the yellow is much more variable in color shad and passes into green by some very fine gradations. There see to be no other characters correlated with seed colors, so that th separation must be made on color alone.

Figure 1 shows an attempt to represent graphically the relatio ships and importance of the various color groups. The solid lines an rectangles represent existing groups and probable relationships; th dotted lines and rectangles indicate possible but still unknown grou or those toward which variation seems to be progressing. The si color groups recognized and described herein are as follows:

I. Black seeded.	IV. Green seeded.
II. Brown seeded.	V. Greenish yellow seeded.
III. Mottled seeded.	VI. Yellow seeded.

KEY TO THE VARIETIES.

It is hoped that the following key will prove useful to those seeking to identify varieties of soy beans. The user is cautioned, however, against placing complete dependence upon the key alone. It should be used only in connection with (1) the table showing average ripening period and average height, (2) the illustrations of seeds and pods, and (3) the fuller notes and descriptions given in the body of the text. From the very nature of these so-called varieties of an agricultural crop they can not be separated by as minute characters as avail in the case of botanical forms.

I. Black Seeded.

Seeds large, 8 to 11 mm. long, round or broadly elliptical, pods 1½ to 3 inches long.
- A. Very early, ninety-five to one hundred days, 18 to 24 inches high, short branched; leaves large, dark; pods 2 inches long or over, seeds spherical or broadly elliptical and somewhat flattened .... *Buckshot.*
- B. As above, but seven to ten days later, branches longer, pods and seeds somewhat smaller .... *Nuttall.*
- C. Late, one hundred and twenty to one hundred and thirty days, about 30 inches tall, branches long, seeds very large, elliptical, much flattened. *Flat King.*

Seeds small, 4 to 6 or 7 mm. long, round or broadly elliptical, pods about 1 inch long.
- A. Medium, one hundred and ten to one hundred and fifteen days, low, 15 to 18 inches tall, scarcely branched, seeds spherical or slightly flattened. *Kingston.*
- B. Medium late, one hundred and fifteen to one hundred and twenty days, 20 to 26 inches tall, long-branched, seeds elliptical, distinctly flattened .. *Ebony.*

Seeds medium, elongated, 5½ to 7 mm. long, about two-thirds as wide, much flattened.
- A. Very late, 3 to 4½ feet tall, very much branched, leaves and pods small. *Riceland.*

II. Brown Seeded.

Early, pods over 1½ inches long, seeds large, 8 to 9 mm. long, round, or nearly so.
- A. Very early, about 20 inches high, branches few and short .... *Ogemaw.*
- B. Early, about 22 inches high, branches very numerous and longer .... *Eda.*

Medium late, 25 inches tall, long branched, pods less than 1⅜ inches long, seeds small, 4 to 6½ mm. long, spherical or round.
- A. Pods distinctly flattened, ⅜ to ½ inch or over in width, seeds deep brown, shining .... *Baird.*
- B. Pods nearly cylindrical, 5/16 inch or less in width, seeds light brown, dull. *Brownie.*

III. Mottled Seeded.

Identical with Riceland, except in color of the elongated seed .... *Hankow.*

Plant not known, seeds large, nearly round .... *Meyer.*

IV. Green Seeded.

Early, low, 15 to 20 inches, short branched, pods slender, commonly 3 seeded, seeds light green, elongated .... *Samarow.*

Medium, one hundred and ten days, 30 inches tall, pods broader, seeds round, deep green .... *Guelph.*

V. Greenish Yellow Seeded.

1. Early, very low, 14 to 18 inches, pods about 1¼ inches long, seeds medium large, roundish or broadly elliptical, hilum pale brown........................ *Yosho.*
2. Medium late, about one hundred and twenty days, 25 to 30 inches high, branches long, pods and seeds as the last, but hilum deep brown................ *Haberlandt.*
3. Late, one hundred and thirty days or over, 35 inches or over in height, very long branched, pods 1½ inches long, seeds larger, round or elliptical, hilum scarcely tinted.. *Tokyo.*

VI. Yellow Seeded.

1. Much-branched plants, branches as long as the main stem; pods small to medium, 1 to 1¼ inches long, often 3 seeded, seeds medium, 5½ to 8 mm. long, round or broadly elliptical, flattened, mostly deep yellow.
   - A. Early, about ninety-five days, 18 to 24 inches tall.................. *Ito San.*
   - B. Medium late, one hundred and twenty to one hundred and twenty-five days, 25 to 30 inches tall.. *Hollybrook.*
   - C. Later, one hundred and twenty-five to one hundred and thirty-five days, taller, 32 to 42 inches... *Mammoth.*
2. Early, low, about 20 inches, scarcely branched, pods larger, seeds 7 to 9 mm., broadly elliptical, yellow, slightly greenish, hilum brown............ *Manhattan.*
3. Low, stocky, somewhat branched, pods large, seeds large, 7 to 9 mm., spherical or slightly flattened, pale yellow, hilum yellow or pale brown.
   - A. Medium early, one hundred to one hundred and five days, about 20 inches tall, branches short... *Butterball.*
   - B. Medium late, one hundred and twenty to one hundred and twenty-five days, a little taller, branches nearly equalling stem.................. *Amherst.*

Figure 2 shows the average number of days required by each variety from date of seeding to the ripening of the crop and also the average height in inches which the plant attains. The longer, more slender line indicates the range of variation in different seasons and at different stations. It does not, in most cases, show the extremes caused by exceptionally favorable or exceptionally unfavorable conditions. The shorter, heavily shaded line indicates the average performance of the variety under average conditions. Probable exceptions, as in the case of Ogemaw, are noted in the descriptions of the varieties.

DESCRIPTIONS OF THE VARIETIES.

Black-Seeded Group.

BUCKSHOT.

The Buckshot is a well-known commercial variety, having been on the market in this country for a number of years. So far as known, it is the only variety with black seeds which is obtainable commercially. It is quite generally sold by northern seedsmen and under several descriptive names, all more or less similar, as Black, Early Black, Medium Early Black, Extra Early Black, Large Black, etc.

It is a rather low and stout, stocky plant, with short branches and large, very dark leaves. The height is medium, varying from 15 to 28 inches,[a] with the average from

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[a] The figures given for height indicate the total height of plant, including the upper leaves.

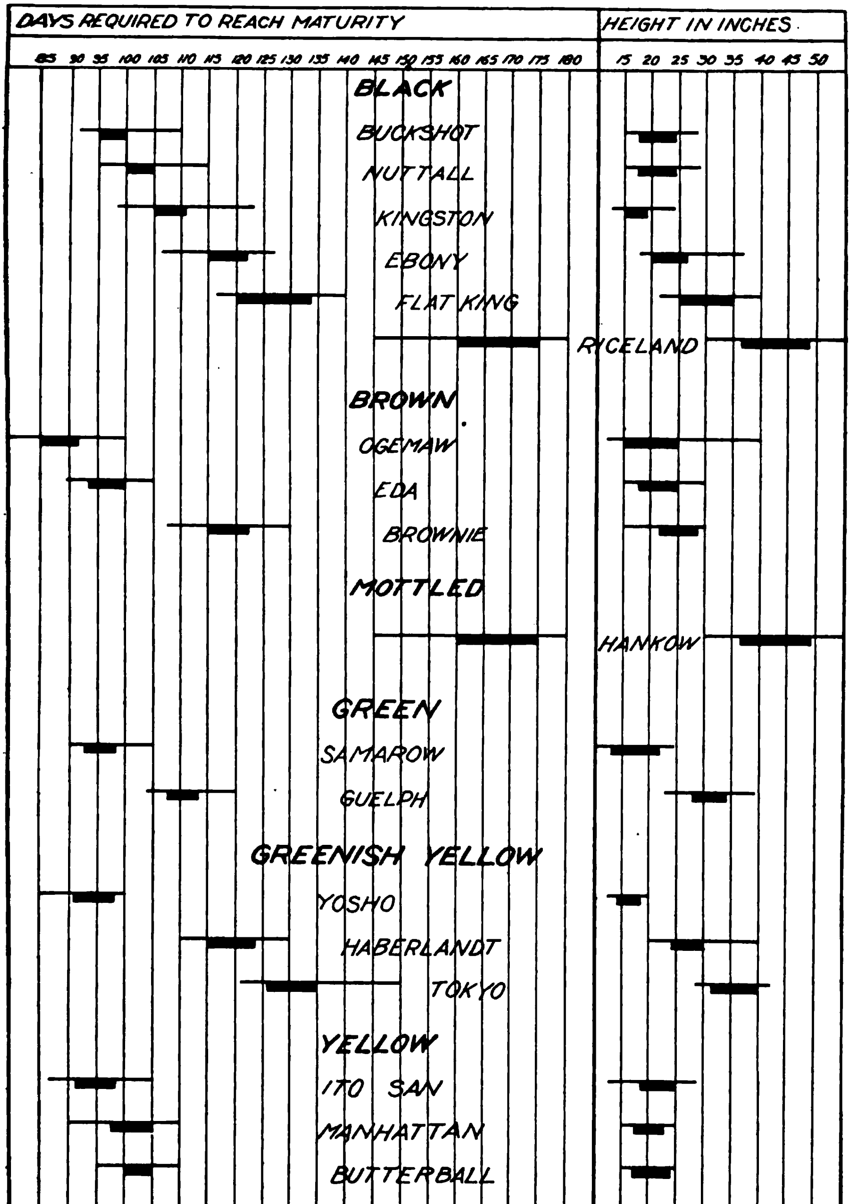

FIG. 2.—Diagram showing for each variety of soy bean the number of days required to reach maturity and the height of the plant in inches. The averages are shown by extra heavy lines.

18 to 24 inches. The stems are of medium thickness, measuring from one-eighth to one-third inch in diameter at the base, with a few (3 to 6) short, appressed branches quite near the ground. On vigorous plants these branches will occasionally be 6 to 10 inches[a] in length. The leaves are large, very dark green in color, broad, and often blunt at the apex. The pods are 2 to 3 seeded, usually 2 seeded, 2 to 3 inches long, one-half inch wide, set very thickly on the short branches and main stalk near its base, often so low as to make harvesting difficult. The seeds are jet black and shining, but usually covered with a powdery bloom, which gives them a dull and grayish, or leaden, color. They are large, 8 to 11 mm. long by 8 to 9 mm. wide, round or very broadly elliptical in lateral view, somewhat flattened when seen in the dorso-ventral view. Seeds from luxuriant vines in moist soil are likely to be somewhat larger and flatter, with the black seed coat wrinkled and sometimes split open.

Although quite widely cultivated in the lower parts of the Northern States, this variety has never become very popular in that section. This seems to be largely due to the fact that the Guelph (medium green), while averaging only ten days later in maturing, also averages 10 inches taller, and is thus considerably more valuable. The Buckshot requires from ninety-two to one hundred and ten days to reach maturity, the average for most locations being ninety-five to one hundred days. It does not mature in the most northern States except in favorable seasons, and then is likely to require about one hundred and twenty days to reach maturity. The name, Buckshot, was suggested by the size, shape, and color of many of the seeds.

Numbers and sources of lots grown.—Agrost. No. 1184, "Black," R. I. Agric. Expt. Station; Agrost. No. 1292, S. P. I. No. 6334, Japan; Agrost. No. 1301, "Early," Johnson & Stokes; Agrost. No. 1303, "Extra Early Black," J. M. Thorburn & Co.; Agrost. No. 1304, W. A. Burpee; Agrost. No. 1471, "Extra Early Black," J. M. Thorburn & Co.; Agrost. No. 1474, "Extra Early Black," Hammond Seed Company; Agrost. No. 1978, union of Agrost. Nos. 1184, 1301, 1304, 1471; Agrost. No. 1979, union of Agrost. Nos. 1292, 1303, 1474; Agrost. No. 2033, "Black," Ark. Agric. Expt. Station; S. P. I. No. 6334, "Round Black," Japan; S. P. I. No. 8491, grown from No. 6334; S. P. I. No. 9412, grown from No. 6334; S. P. I. No. 11179, "Early Black," source not known; S. P. I. No. 17251, union of Agrost. Nos. 1978, 1979, 2033, and S. P. I. No. 11179.

NUTTALL.

This variety is closely related to the Buckshot, but is distinguished by smaller seeds and rather stouter and more branching plants. The stems are stout, from one-third to one-half inch in diameter at the base, and ranging from 15 to 28 inches in height, with the average between 17 and 24 inches. The plants are usually well branched and the branches spreading, nearly closing the spaces between 3-foot rows on good soil. The leaves are large and medium green in color. The pods are 2 to 3 seeded, but rather more than usual contain 3 seeds each, and occasionally there is one with four seeds. From 2 to 4 pods are borne on each peduncle. The pods are medium, about 2 inches long, one-fourth to three-eighths inch wide, often not turning brown until after the seeds are ripe. The pods do not dehisce readily, commonly remaining closed until the seed is fully ripe. The seeds are jet black and shining, with usually little or no powdery bloom, medium to large in size, 7 to 9 mm. long, 6 to 8 mm. wide, round or broadly elliptical in outline from a lateral view, distinctly flattened from the dorso-ventral view. The Nuttall requires from one hundred to one hundred and fifteen days to ripen its seeds, the average time being one hundred and five to one hundred and ten days. This variety has apparently but very little to recommend it. It is later than the Buckshot, and, though well branched, the total height is not increased, so in that respect it can not compare with the Guelph variety. In seed yields, where sown thickly enough to make fair forage, it has not done much. From 4 to 6 bushels to a little more than 12 bushels to the acre are the recorded outputs.

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[a] The figures given for the length of branches are for the naked branch only. With leaves attached the branches are from 7 to 9 inches longer.

The name is given in honor of Thomas Nuttall, who wrote the first recorded account of the soy bean in this country.

Numbers and sources of lots grown.—Agrost. No. 1536, S. P. I. No. 6416; S. P. I 6416, "Black," from Korea; S. P. I. No. 8496, grown from S. P. I. No. 6416; S. P. I. No. 9418, grown from S. P. I. No. 8496; S. P. I. No. 17253, grown from Agrost. No. 1536–1.

KINGSTON.

This is a small, medium early variety, with rather slender stems, one-eighth to three-eighths inch in diameter at the base, and 12 to 24 inches high. The average height is 16 to 18 inches. The stems are either unbranched or with three to six short appressed branches at the base, 1 to 2 inches long. The general color of the foliage is from a medium to dark green, and the leaves are large and less pointed than in Ebony. The pods are very small, averaging smaller than those of Ebony, three-fourths to 1 inch in length and one-fourth inch in width, 2 to 3 seeded, borne very thickly on the main stem, often to within 2 inches of the ground. The full-grown but still unripe pods bear a strong resemblance to young peanut pods, being cylindrical and considerably constricted between the seeds. The seeds are the smallest of any black variety, and are equaled in smallness by the Brownie only. They are entirely round in outline, no long diameter being discernible, 4½ to 6 mm. broad, jet black and shining, with only a slight bloom, and only moderately flattened in dorso-ventral view.

This variety is too small and unbranched to have much value for forage. It is likely to prove a fairly good yielder of seed, two tests sown thickly for forage having yielded between 8 and 9 bushels of seed per acre. In time of ripening it is medium early, requiring from one hundred and four to one hundred and twenty-two days, or averaging one hundred and ten to one hundred and fifteen days.

The name, Kingston, is given in honor of the Rhode Island Experiment Station, located at Kingston, R. I. That station has contributed largely to our knowledge of the soy bean as a crop for northern regions, and this variety was received from that source alone.

Numbers and sources of lots grown.—Agrost. No. 1188, "Japanese No. 15," R. I. Agric. Expt. Station; S. P. I. No. 17255, grown from Agrost. No. 1188–1.

EBONY.

The very small-seeded variety known as Ebony is not to be had on the market, and it has apparently been obtained abroad but once. The original importation was from Ping-yang, Korea. In size of seed and pod it is, with the exception of Kingston, the smallest of all the black soy beans and one of the few very small-seeded varieties of any color.

The Ebony variety is characterized by rather slender stems, one-eighth to one-fourth inch in diameter at the base and 18 to 36 inches tall, erect, and usually well branched. The branches are long and slender, spreading at an angle of about 45°, thus giving the plant a very bushy habit. The leaves are small to medium in size, averaging 1½ to 2½ inches long, and are medium green in color. A good crop of pods is borne on stem and branches alike. The pods are very small, three-fourths to 1 inch in length by one-fourth inch in width, each containing 2 or rarely 3 seeds. The seeds are small, jet black, shining, with scarcely any trace of bloom, round to broadly elliptical in outline, mostly the latter, 5 to 6½ or 7 mm. long, 4½ to 5½ or 6 mm. wide, rather more variable than in the other black varieties, quite distinctly flattened in dorsoventral view.

The growth the first season was small but plants of the second and third generations were 18 to 36 inches high, according to locality. This variety closely resembles the Nuttall in habit of growth, but is much later in maturing and has very much smaller pods and seeds. It has, apparently, the bad habit of not holding its leaves well until the pods are ripe, and it is not likely to be regarded as of value unless that fault is eliminated by selection. As a hay crop, designed to be cut before fully mature, it would do very well. The other characters, such as slender stems, fair height, and long, slender branches, as well as a good crop of pods, all mark it as of probable value for hay. It requires from one hundred and seven to one hundred and twenty-seven days to reach maturity, the average being from one hundred and fifteen to one hundred and twenty-two days.

The name has reference to the color of the seeds.

Numbers and sources of lots grown.—Agrost. No. 1193, S. P. I. No. 6386; Agrost. No. 1541, S. P. I. No. 8492; Agrost. No. 1980, Agrost. Nos. 1193 and 1541, united; S. P. I. No. 6386, "Black," Korea; S. P. I. No. 8492, grown from S. P. I. No. 6386; S. P. I. No. 9414, grown from S. P. I. No. 8492; S. P. I. No. 17254, grown from Agrost. No. 1980.

FLAT KING.

The Flat King is a tall and quite stout variety, with stems one-half inch in diameter at the base, often branching quite freely, 20 to 30 inches high in drier regions, 30 to 40 inches in more favorable localities. The branches are 5 to 7 in number, the lower ones 10 to 14 inches long, the upper 4 to 8 inches, ascending or spreading, nearly meeting across the spaces between rows 3 feet and more apart. The leaves are large, abundant, and medium to dark in color. This variety bears usually a heavy crop of pods, but these are commonly quite close to the ground, making harvesting rather difficult, especially where the plants are low. The pods are large, 2 to 2½ inches long, one-half inch wide, usually loosely 2 seeded. The seeds are larger and flatter than those of any variety, jet black, shining, with little or no bloom, flat, broadly elliptical in outline, 7 to 9 mm. wide, 8 to 12 mm. long, a common size for well-developed beans being 8 by 11 mm., only 3½ to 4 mm. thick, occasionally somewhat pointed at the ends.

The Flat King is a very strong-growing variety, resembling the Nuttall more closely than any other black-seeded form, though the Flat King is the taller, its average height being from 25 to 35 inches. It is not a commercial variety yet, but its heavy crop of pods, its large size, and branching habit make it a valuable variety for trial as a silage crop or for a cover crop or hog pasture, especially in the Southern States. It is later than any of the large and promising varieties, except the Tokyo, and is more comparable with the Mammoth in time of maturity, requiring from one hundred and seventeen to one hundred and forty days or even more in unfavorable seasons. Yields of seed of from 6 to 9 bushels to the acre have been recorded.

The name is given on account of the much flattened seeds and the large size of seeds and plants.

Numbers and sources of lots grown.—Agrost. No.1293, S. P. I. 6312; S. P. I. No. 6312, "Flat Black," Japan; S. P. I. No. 8497, grown from S. P. I. No. 6312; S. P. I. No. 9410, grown from S. P. I. No. 8497; S. P. I. No. 17252, grown from Agrost. No. 1293–2.

RICELAND.

This is one of two very peculiar varieties imported from China. These two, the Hankow being the second one, are very similar in habit, differing only in the color of the seeds. They are, however, quite different from all other varieties studied. In appearance they scarcely suggest the familiar type of soy beans. Where sufficient moisture may be had they attain the greatest height of any varieties yet grown.

The main stem is stout at the base, one-fourth to one-half inch in diameter there, but soon becomes reduced in size and flexuous or somewhat twining in habit. It is then no longer distinguishable from the larger branches. The entire plant reaches a height of from 3 to 5 feet. The long slender branches spring abundantly from the whole length of the stem. They frequently equal or even exceed the main stem in length, and are themselves repeatedly branched. The long lower branches are inclined to become prostrate unless the rows are close enough together to give some support one to another. The tips of the branches become actually twining and often tangle themselves together. The leaves are very small, only 1 to 2 inches in length, narrow, medium green to light green in color. The pods also are very small, scarcely 1 inch long by about one-fourth inch wide. They are scattered quite uniformly over the long stem and branches. The seeds are medium small and elongated in proportion to their width, jet black, shining, the original seed so heavily coated with powdery bloom as to obscure the ground color entirely, the generations grown in this country much less thickly covered, narrowly elliptical, 4 to 5 mm. wide, 5½ to 7 mm. long, a common size being 4½ by 6½ mm., very much flattened, only 2½ to 3 mm. thick.

The Riceland has not yet been placed on the market. It is known only from the original importation from beyond Chiu Niu, near Hankow, province of Hupeh, in the great valley of the Yangtze, China, where it is sown in July or August, between the rows of rice. It ripens late in the fall after the rice is harvested. It is thus accustomed to very wet soils. In the trials made in this country it has required from one hundred and fifty to one hundred and eighty days to reach maturity. It is probable, however, that if treated here as in China, viz, planted late in wet ground, it would still come to maturity before frost, at least in the South, and in a considerably shorter period than if sown earlier. Its numerous slender branches, fine foliage, and tall growth are indicative of great value as a hay plant. It does not do well at all in dry regions and should be tested only on moist or wet soils. It is worthy of very careful trials under these conditions.

S. P. I. No. 16790 from Hangchow, China, is probably another lot of this striking variety. This lot has not been grown by the writer, but it is characterized by the same narrowly elliptical, flattened seeds. They average slightly larger than those just described, some reaching 5 by 8 mm. Hangchow is also in the rice-growing section of China.

The name, Riceland, is suggested by the use of this variety by the Chinese in their rice fields.

Numbers and sources of lots grown.—Agrost. No. 964, S. P. I. No. 6560; S. P. I. No. 6560, from beyond Chiu Niu, near Hankow, China.

BROWN-SEEDED GROUP.

OGEMAW.

The Ogemaw soy bean has recently been brought to public notice and put on the market by Mr. E. E. Eyans,[a] of West Branch, Mich., as an extra early form for northern latitudes. The writer has had it under test for only one season, that of 1905. In all trials made, mostly in the middle South and Southwest, it has shown itself to be a dwarf and stocky early variety. Since the well-known effect of sowing northern-grown seed in the South is to check its vegetative vigor for at least one season, it may be assumed that the Ogemaw is likely to have a greater average height than it reached last year, which was only 10 to 20 inches. In Upper Michigan it has been reported to have an average height of 38 inches, which is well toward the other extreme. It is likely that further trials will prove the Ogemaw identical with the next variety, Eda, except perhaps in time of ripening.

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[a] Mr. Evans spells the name "Ogema," which is likely to prove confusing in pronunciation to those unfamiliar with the name. Prof. C. D. Smith, director of the Michigan Experiment Station, states that the name was derived from the county "*Ógemaw*," and the writer prefers the longer spelling as being more likely to be correctly pronounced.

The Ogemaw soy bean has stems of medium size, one-fourth to three-eighths inch in diameter at the base, freely branching, with short and usually appressed branches 2 to 4 inches long, thickly set with brown pods, 1½ to 2 inches long, three-eighths to one-half inch wide, 2 to 3 seeded, usually becoming brown before the seeds are ripe, and with an unfortunate tendency to shatter easily, even before fully mature. The seeds are large and plump, round or very broadly elliptical in outline, 8 to 9 mm. long, 7 to 9 mm. wide, somewhat flattened in cross section. In color they are a deep brown when mature. Before maturity they are light brown. A sample is likely to contain seeds in various stages of ripeness, and hence to present all shades of brown in color, sometimes on a single seed. Stored seed becomes darker with age. Mature seeds are commonly quite shiny. The Ogemaw is one of our very earliest varieties, ripening in from eighty-two to one hundred days, with the average somewhere about eighty-eight to ninety days. It has not shown itself a specially heavy yielder of seed, due partly to the early dehiscence of the pods and shattering of the seeds.

Numbers and sources of lots grown.—Agrost. No. 1992, "Ogemaw," E. E. Evans, Mich.; Agrost No. 2031, "Crossbred No. 6," Ark. Agric. Expt. Station; S. P. I. No. 13502, Agrost. No. 1992; S. P. I. No. 17258, grown from Agrost. No. 1992; S. P. I. No. 17259, grown from Agrost. No. 2031.

EDA.

The Eda variety is very similar to the Ogemaw and is likely to prove identical with it when the Ogemaw has become more fully acclimated and has regained its normal size. The Eda differs from the Ogemaw variety chiefly in its greater height, longer branches, and in being a week or so later in maturing. In short, it is a larger and more vigorous plant, which the Ogemaw is likely to equal in another trial with home-grown seed.

The Eda is a medium-sized, well-branched plant, from 16 to 30 inches high, branches 6 to 12, more numerous than in any other small variety, the lower ones 6 to 10 inches long, erect appressed, and therefore not giving the plant a bushy appearance. Stems and branches podded well, but not too close to the ground; pods 1¼ to 1¾ inches long, three-eighths to one-half inch wide. Fairly early, maturing in from one hundred to one hundred and ten days. The seeds are almost identical with those of Ogemaw, round or broadly elliptical, 7 to 9 or 10 mm. long by 7 to 9 mm. broad, deep brown, shiny, but usually covered with more or less powdery bloom, which gives them a dull appearance.

The plat of this variety grown at the Tennessee Experiment Station in 1905 had foliage of a most striking and peculiar coppery-green color not observed in any other plat.

The name, Eda, is a part of the longer name under which this variety was received.

Numbers and sources of lots grown.—Agrost. No. 1185, "Brown Eda Mame," R. I. Agric. Expt. Station; S. P. I. No. 17257, grown from Agrost. No. 1185-1.

BAIRD.

The seed of this variety was mixed with the original and only importation of the Brownie variety, described later. In all the brown varieties, except the Brownie, the seeds are deep brown when ripe, but light brown when nearing maturity. For this reason the light brown seeds of the Brownie and the deep brown seeds of the Baird varieties were thought to represent the immature and mature seeds, respectively, of a single variety, which was called Brownie.

The Baird variety is readily distinguished from the Brownie by its slightly larger and more flattened deep brown seeds. The pods also are distinctly larger and more flattened, three-eighths to one-half inch or more in width, 1⅛ to 1⅜ inches in length, apparently remaining nearly yellow at maturity.

The characters of the plant have not been recorded, but it is probably coarser and less branched, though earlier, than that of the Brownie variety. From the Ogemaw and Eda varieties it is separated by its smaller pods and much smaller seeds. It is probably much like them in habit, but longer branched and later.

As this variety was separated from the Brownie after the plates were prepared, its name does not appear on Plate III. It is, however, represented by the two left-hand seeds in No. 9 on Plate I and by the four left-hand seeds and the lower pod attributed to the Brownie variety on Plate III, as noted in the description of the plates.

The variety is named for Rev. W. M. Baird, a missionary, who secured the seed in Korea.

BROWNIE.

This is a well-branched, bushy variety, with very small pods and seeds. It is not known commercially, but only through the original importation from Korea.

The stems are medium in size, one-fourth to three-eighths inch in diameter at base, bearing 3 to 6 branches, the lowermost 15 to 20 inches long, the upper gradually shorter, all ascending or spreading, giving to the plant a bushy, wide-spreading habit. Leaves of medium size and medium to light green in color. Pods borne quite abundantly, 3 to 6 to the cluster, very small, nearly cylindrical, three-fourths inch to 1¼ inches long, three-sixteenths to five-sixteenths inch wide, 2 or occasionally 3 seeded, remaining greenish yellow until nearly ripe, then becoming somewhat reddish. The seeds are all round or spherical, 4 to 6½ mm. in diameter, the normal color a light brown, resembling the seeds of some forms of the gram (*Phaseolus mungo*).

From one hundred and eight to one hundred and twenty-five or more days are required to bring this variety to maturity, the average being about one hundred and fifteen to one hundred and twenty days. The longer periods seem to be accompanied by a considerably taller growth, and it seems likely that with careful selection this variety can be developed into a very valuable hay plant. The few yields of seed recorded are all small, usually less than 5 bushels to the acre.

The name is derived from the color and small size of the seeds.

Numbers and sources of lots grown.—Agrost. No. 1542, S. P. I. No. 6414; S. P. I. No. 6414, from Ping-yang, Korea; S. P. I. No. 9417, grown from S. P. I. No. 6414; S. P. I. No. 17256, grown from Agrost. No. 1542-1.

MOTTLED-SEEDED GROUP.

HANKOW.

The description and notes already given for the Riceland apply equally well to the Hankow variety, except for the color of the seeds. Both were obtained in China at the same time and place and were noted as being grown in the same way for the same purpose. In all the tests made they have behaved exactly alike. The seeds are of medium size, rather narrowly elliptical, 4 to 5½ mm. wide by 6 to 8 mm. long, 5 to 6½ mm. being a common size. The ground color is light to medium brown and the mottling is black. The black is present usually as a more or less sharply defined patch or saddle of varying size and elliptical shape on either side of the "eye," or hilum. In addition, there are usually one or two narrow or broader eccentric lines or stripes of black outside the patch and parallel to its edge, thus forming a broken ellipse near the margin of the flattened seed. The two sides of a bean are frequently unlike in their markings.

S. P. I. No. 9344, from China, has very similar seeds, rather plumper, and much discolored, but with more dark color than in the variety just described. The black is usually massed as a saddle around the eye and extending outward over about half or more of the surface. This serial number has not been tested by the writer, and its characteristics are not known.

The name is derived from the city of Hankow.

Numbers and sources of lots grown.—Agrost. No. 972, S. P. I. 6559, from Chiu Niu (near Hankow), China.

MEYER.

S. P. I. No. 17852 is a recent importation from China, secured by Mr. F. N. Meyer. From the seed alone it is certain that this is a distinct variety of the mottled group. The seeds are plump and shiny, broadly elliptical, 6½ to 8 mm. broad, 7 to 10 mm. long, the ground color deep brown, with patches or blotches of black on either side near the hilum and eccentric curved lines or stripes of the same color near the dorsal edge. The amount of this black color is quite variable, some seeds being quite covered with it and some showing only faint lines of it.

GREEN-SEEDED GROUP.

SAMAROW.

Samarow is a dwarf early variety of unknown origin. It has been sold for several years by J. M. Thorburn & Co., New York, under the name Green Samarow. It may readily be distinguished from all other varieties by the elongated, flattened, light-green seeds, quite different in shape from those of any varieties which are similar in color.

The stems of the Samarow variety are slender, one-eighth to one-fourth inch in thickness at the base, 10 to 24 inches tall, well branched with short branches, the lower ones only 4 to 5 inches long, ascending or spreading; leaves broad but not large, generally very dark green. The stem and branches are thickly set with medium-sized pods, 1¼ to 1¾ inches long by one-fourth to one-third inch wide, 2 to 4 seeded; often one-half of the pods on a plant will contain 3 seeds each, which is a higher proportion than has been observed in any other variety, while pods containing 4 seeds each are not uncommon. The seeds are elliptical, distinctly elongated, or some almost reniform (kidney-shaped), 5 to 6½ mm. wide by 7 to 9 mm. long, dull to faintly shining, very pale green or pea green in color. The variety may be easily recognized by the elongated, pale green seeds, the only other elongated seeds being black or mottled.

The Samarow soy bean requires from ninety to one hundred and five days to come to full maturity, the average being about ninety-five days. It is a fair to good yielder of seed and it is for this purpose that it is likely to be grown. The yields reported run from 5 to nearly 15 bushels per acre. The small size of the plants makes it unprofitable to grow for forage production, but the abundant crop of pods, containing 3 seeds commonly and 4 occasionally, suggests the possibility of breeding for high seed yields.

Numbers and sources of lots grown.—Agrost. No. 1302, "Green Samarow," J. M. Thorburn & Co.; Agrost. No. 1470, "Green Samarow," J. M. Thorburn & Co.; Agrost. No. 1972, "Green Samarow," union of Agrost. Nos. 1302 and 1470; S. P. I. No. 17260, grown from Agrost. No. 1972.

GUELPH.

The Guelph is one of the oldest and best known of the varieties in cultivation. For many years it has been sold by numerous seed houses as Early Green, Medium Green, and Medium Early Green. It is a rather curious fact that during the eight years in which the United States Department of Agriculture has been actively engaged in the introduction of oriental legumes it has but once secured this variety. This is probably due to the fact stated by writers on Japanese agriculture that the green-seeded and the brown-seeded forms are but sparingly cultivated in the Orient, the blacks and yellows being much preferred.

The Guelph soy bean has become quite a favorite in the Northern States of this country, where it is highly esteemed for both seed and forage production. In Kansas, Indiana, Michigan, and in Ontario it has given splendid results in comparative tests extending through several years.

The Guelph variety grows from 24 to 38 inches high, stems medium stout,one-fourth to three-eighths inch in diameter, well branched with ascending or spreading branches, 6 inches long at the bottom, often completely filling the space between rows 3 to 3½ feet apart. The leaves are very dark green, large and full in the center, with the margin often much wrinkled or crinkly, due to vigorous but uneven growth of the different parts of the leaf. The pods are medium in size, 1 to 1½ inches long by three-eighths inch wide, 2 to 3 seeded, borne thickly on the main stem and branches and usually far enough above the ground to permit easy harvesting. The seeds are nearly round in outline, 6 to 8 mm. in diameter, distinctly flattened, 4 to 5 mm. thick in dorso-ventral view. In color they are bright green and quite shiny.

The Guelph variety is medium in time of ripening, varying from one hundred and five to one hundred and twenty days, one hundred and eight to one hundred and fourteen days being the average time. Six lots of this variety tested at the Kansas Experiment Station in 1903 all ripened in one hundred and seven days, yielding from 3⅘ to 10⅕ bushels of seed to the acre and averaging 6½ bushels. Eight lots tested at Washington the same year matured in one hundred and five to one hundred and fifteen days, yielding from 5⅘ to 14$\frac{1}{10}$ bushels to the acre, the average being 8⅗ bushels. Yields of from 16 to 18 bushels were secured in Indiana. At the Ontario Experiment Farm the average annual yield of green fodder for a period of four years was 11 tons to the acre. Virginia and Delaware report yields of 7 to 10 tons of green forage to the acre. This variety shatters rather badly if allowed to become fully ripe, which is an objection to its use as a seed crop. Its large size and freely branching habit make it a most excellent variety for pasture, hay, silage, and cover crop, and for these purposes it should be widely grown.

At the Ontario Agricultural College and Experiment Farm, located at Guelph, Ontario, a great deal of work has been done with soy beans, and with this variety especially, and the name is given for that reason.

Numbers and sources of lots grown.—Agrost. No. 912, "Early Green," J. M. Thorburn & Co.; Agrost. No. 969, S. P. I. No. 6558; Agrost. No. 1306, "Medium Early Green," J. M. Thorburn & Co.; Agrost. No. 1312, "Medium Green," Henderson & Co.; Agrost. No. 1464, "Early Green," Henderson & Co.; Agrost. No. 1467, "Medium Early Green," J. M. Thorburn & Co.; Agrost. No. 1469, "Medium Early Green," Breck & Sons; Agrost. No. 1473, "Medium Early Green," Hammond Seed Co.; Agrost. No. 1476, "Medium Early Green," Currie Bros.; Agrost. No. 1764, "Early Green," Kans. Expt. Station; Agrost. No. 1971, "Medium Green," union of Agrost. Nos. 912, 969, 1306, 1312, 1464, 1467, 1469, 1473, and 1476; S. P. I. No. 6558, Hankow, China; S. P. I. No. 13503, Agrost. No. 912; S. P. I. No. 17261, grown from Agrost. Nos. 1764 and 1971.

GREENISH-YELLOW-SEEDED GROUP.

YOSHO.

The Yosho is a rather small, early form, with small stems, one-fourth inch in thickness, 12 to 30 inches high, with a few rather short branches, 2 to 4 inches long, rather stocky and bushy in appearance. Leaves large, medium green in color; pods only fairly abundant, medium sized, 1¼ to 1¾ inches long by three-eighths inch or more wide, 2 or occasionally 3 seeded. The seeds are medium to large in size, 6½ to 7½ mm. wide, 7 to 8 mm. long, nearly round or broadly elliptical, somewhat flattened, greenish yellow and shining when fresh, becoming paler and duller with age, the hilum marked with pale brown.

Yosho is a very early variety, maturing in eighty-five to one hundred days, averaging ninety-two to ninety-seven days. It gives only a fair yield of seeds and a low yield of vines. Seed yields of 4⅗ to 6⅗ bushels per acre are recorded.

The name is formed by shortening the Japanese word Yoshioka.

Numbers and sources of lots grown.—Agrost. No. 1297, S. P. I. No. 6314; S. P. I. No. 6314, "Yoshioka," Japan; S. P. I. No. 8489, grown from S. P. I. No.6314; S. P. I. No. 17262, grown from Agrost. No. 1297-2.

HABERLANDT.

The stems are medium size, one-fourth to three-eighths inch in diameter at the base, 20 to 40 inches in height, the average being 24 to 30 inches, well provided with numerous long, ascending to rather wide-spreading branches, the lower ones from 6 to 12 inches or more in length; the leaves medium to broad, narrowed toward the tip, medium to light green in color. A plot grown in 1905 at Baton Rouge, La., had foliage of a very light glaucous green, much resembling a plot of rape in color. The same appearance was also reported for this variety by the Virginia Agricultural Experiment Station. The stem and long branches are well set with pods 1¼ to 1¾ inches long and three-eighths to one-half inch wide. The seeds are medium or large, the present generation (1905) nearly round, 6½ to 8 mm. wide by 7 to 8 mm. long, clear greenish yellow, shining, decidedly paler when two or three years old, the third generation back from the present larger and longer, 7 to 8 mm. wide by 7 to 9½ mm. long, all somewhat flattened; hilum deep brown.

The time required for this variety to reach maturity varies from one hundred and ten to one hundred and thirty days, the average time being somewhere near one hundred and eighteen to one hundred and twenty days. Two seed yields secured were $12\frac{9}{10}$ and $13\frac{3}{10}$ bushels to the acre, respectively. The Haberlandt is one of the most promising varieties for hay, silage or green manuring, and for a cover crop. From the Tokyo it can be distinguished only by its earlier maturity, rather deeper greenish yellow seed and distinctly brown hilum.

This variety was named in honor of Prof. A. Haberlandt, who first brought the soy bean to agricultural notice in Europe. His work was published in 1878 at Vienna.

Numbers and sources of lots grown.—Agrost. No. 1194, "White," S. P. I. No. 6396; Agrost. No. 1539, S. P. I. No. 8495; Agrost, No. 1540, S. P. I. No. 8493; S. P. I. No. 6396, "White," Ping-yang, Korea; S. P. I. No. 6397, Ping-yang, Korea; S. P. I. No. 8493, grown from S. P. I. No. 6396; S. P. I., No. 8495, grown from S. P. I. No. 6397; S. P. I. No. 9415, grown from S. P. I. No. 8493; S. P. I. No. 9416, grown from S. P. I. No. 6397; S. P. I. No. 17263, grown from Agrost. No. 1539-1; S. P. I. No. 17271; grown from Agrost. No. 1194-1.

TOKYO.

The Tokyo differs from the medium greenish yellow (Haberlandt) variety mostly in a somewhat more vigorous growth and in later ripening. It is a very large and vigorous, long-branched variety; stems one-fourth to one-half inch in thickness, 28 to 42 inches in height. In this it scarcely excels the best records for the Haberlandt, but in the average height reached, about 36 inches, it considerably overtops that variety. The branches are 5 to 10 in number, the lower ones 10 to 15 inches long, ascending or spreading, the plant bushy enough to completely close the spaces between 3½-foot rows, inclined to be top-heavy and to lodge somewhat where grown thinly. The leaves are large, 3 to 4 inches long, 2 to 2½ inches wide, medium to very dark green in color. The pods are large, 1½ to 2 inches in length, about one-half inch in width, 2 to 3 seeded. Seeds large, 7 to 9 mm. wide by 7 to 10 mm. long, round or broadly elliptical, somewhat flattened or occasionally spherical, greenish yellow, shiny, paler and duller with age. The seed of later generations is noticeably smaller than that of the earlier ones, probably due to too thick planting of so large a variety and to forcing maturity in a shorter growing season.

The Tokyo is one of the very best varieties for all-round use. It will give heavy hay and silage crops, is equally good for pasture and cover-crop purposes, and where it matures it gives very good seed yields. Eight plots grown at Washington in two different years averaged 8⅓ bushels of seed per acre, in which the lowest yield was 4 bushels and the highest 14½ bushels. The Kentucky Agricultural Experiment Station reports a very much higher seed yield, with the weight of green forage to the acre 11.84 and 14.08 tons from two plots, curing to 5.44 and 6.16 tons, respectively. It is too late for the best results in most Northern States, but it may be replaced there by the Haberlandt variety.

This variety was named for the Japanese capital, where some of the importations were secured.

Numbers and sources of lots grown.—Agrost. No. 468, grown from S. P. I. No. 4914; Agrost. No. 696, grown on Potomac Flats; Agrost. No. 1171, "Best Green," S. P. I. No. 9409; Agrost. No. 1198, "Late Ita Name," S. P. I. No. 8424, Japan; Agrost. No. 1200, "Medium Ita Name," S. P. I. No. 8423, Japan; Agrost. No. 1298, "Medium Green," S. P. I. No. 6335, Japan; S. P. I. No. 4914, "Best Green," Japan; S. P. I. No. 5766, grown from No. 4914; S. P. I., No. 6335, "Medium Green," Japan; S. P. I., No. 8423, "Medium Ita Name," Japan; S. P. I. No. 8424, "Late Ita Name," Japan; S. P. I. No. 9409, grown from S. P. I. No. 5766; S. P. I. No. 17264, grown from Agrost. No. 1198–1; S. P. I. No. 17265, grown from Agrost. No. 1200–1; S. P. I. No. 17266, grown from Agrost. No. 1171–1; S. P. I. No. 17267, grown from Agrost. No. 1298–2.

YELLOW-SEEDED GROUP.

ITO SAN.

Ito San is probably the best known variety of soy bean on the market. The original source of the variety is not known, but it was very probably one of the early importations made by the Kansas and Massachusetts agricultural experiment stations; perhaps by others also. It has been long and widely sold under the names "Yellow," "Early Yellow," "Early White," etc. It is said that the name "Ito San" was given it by Mr. E. E. Evans, of West Branch, Mich. The greatest value of the Ito San lies in its earliness and fairly large yield of seeds. It is too small to yield heavily for hay, silage, etc. It remains, however, one of the most popular varieties on the northern market.

The Ito San is a rather small, early variety, with slender stems about one-fourth inch in thickness at the base, 12 to 28 inches high, the average being 18 to 24 inches; the branches are long and numerous, ascending or erect, nearly or quite equaling the main stem in height; leaves small to medium, narrow, light green to almost a bluish or glaucous green; pods scattered along the whole length of the main stem and the branches, slender, 1¼ to 1¾ inches long, three-eighths inch wide, 2 or often 3 seeded. The seeds are small, 5 to 6½ mm. wide, 5½ to 7 mm. long, round or slightly elliptical, a pale lemon-yellow, scarcely shiny when fresh, becoming paler and duller with age, hilum occasionally brownish, but normally yellow.

Ito San commonly matures in from ninety to one hundred days, with the average between ninety and ninety-five days. Occasionally it ripens in less than ninety days, and in cold, wet seasons it will require more than one hundred days. It is rather too small for best results as a hay and silage crop, except where quick returns are desired. The Kentucky Agricultural Experiment Station reports $5\frac{3}{10}$ tons of green fodder per acre, curing to 1½ tons. In Ontario, Canada, the average height for four years was 27 inches and average yield of green hay 8½ tons. In 1903 the Kansas Agricultural Experiment Station secured yields of 14½ to $15\frac{7}{10}$ bushels of seed from four different plats. All showed a high percentage of nondehiscence of the pods—88 to 96 per cent. At the Massachusetts Agricultural Experiment Station the seed yields have varied between 18 and 20 bushels in favorable years.

Numbers and sources of lots grown.—Agrost. No. 658, "Kaiyuski Daizu;" Agrost. No. 1183, "Adzuki," R. I. Agric. Expt. Station; Agrost. No. 1186, "Yellow;" Agrost. No. 1187, "Early White," R. I. Agric. Expt. Station; Agrost. No. 1189, "Yellow Eda Mame," R. I. Agric. Expt. Station; Agrost. No. 1192, "Kiyusuke Daidzu," R. I. Agric. Expt. Station; Agrost. No. 1294, "Rokugatsu," S. P. I. No. 6326; Agrost. No. 1313, "Ito San," J. M. Thorburn & Co.; Agrost. No. 1316, "Early," F. Barteldes & Co.; Agrost. No. 1468, "Ito San," J. M. Thorburn & Co.; Agrost. No. 1475, "Ito San," Hammond Seed Co.; Agrost. No. 1478, "Early Yellow," Currie Bros.; Agrost. No. 1765, "Early Yellow," Kansas Agric. Expt. Station; Agrost. No. 1973, union of Agrost. Nos. 1183, 1186, 1187, 1294; Agrost. No. 1974, union of Agrost. Nos. 1189, 1192, 1316, 1478, 1540; Agrost. No. 1975, union of Agrost. Nos. 1316, 1468, 1475; S. P. I. No. 6326, "Rokugatsu," Japan; S. P. I. No. 17268, grown from Agrost. Nos. 1765, 1973, 1974, 1975.

MANHATTAN.

The Manhattan is a dwarf early variety with medium stems 15 to 24 inches high, averaging about 20 inches, stocky, branches short and ascending; leaves medium to large, dark green in color; pods numerous, 1½ to 2 inches long, three-eighths to seven-sixteenths inch wide, 2 to commonly 3 seeded; seeds medium in size, round, broadly elliptical in outline, 7 to 8 mm. wide, 7 to 9 mm. long, considerably flattened, rather pale yellow with a slight greenish tinge, becoming paler with age, hilum brown.

The Manhattan variety is early to medium early, requiring from ninety to one hundred and ten days to reach maturity, the average being about one hundred to one hundred and five days. It is too small to have much forage value, and its chief use will be for an early seed crop, to which purpose it is fairly well adapted. Several yields of from 14 to 16 bushels to the acre are recorded.

This variety was named for the location of the Kansas Agricultural Experiment Station, Manhattan, Kans., where the soy bean has been under extensive experimentation for many years.

Numbers and sources of lots grown.—Agrost. No. 1295, S. P. I. No. 6333; S. P. I. No. 6333, "Gosha," Japan; S. P. I. No. 8490, grown from S. P. I. No. 6333; S. P. I. No. 9411, grown from S. P. I. No. 6333; S. P. I. No. 17277, grown from Agrost. No. 1295-2.

BUTTERBALL.

An early or medium early variety, with short, stocky, unbranched stems, dark foliage, and large yellow seeds. Plants low, 15 to 25 inches high, stems small to medium, one-eighth to one-fourth inch in size at the base, with 2 to 5 short, stubby branches near the base; leaves large, usually dark green. Pods broad, 1¼ to 2 inches long, one-half inch wide, 2 or rarely 3 seeded. The seeds are large, 7 to 8½ mm. wide, 7 to 9 mm. long, spherical, pale lemon-yellow, somewhat shiny, becoming much paler and duller with age, the hilum pale or slightly brownish.

This variety is too small to have much value except for earliness and large size of the seed. The last quality may entitle it to attention in breeding experiments. It matures in ninety-five to one hundred and ten days. Yields of 8¾ and 14⅗ bushels of seed to the acre are recorded.

The name, Butterball, was given to this variety on account of its round yellow seeds.

Numbers and sources of lots grown.—Agrost. No. 1197, "Early Japan," R. I. Agric. Expt. Station; Agrost. No. 1199, "Early Ita Name," S. P. I. No. 8422; S. P. I. No. 8422, "Early Ita Name," Japan; S. P. I. No. 17273, grown from Agrost. No. 1197-1; S. P. I. No. 17274, grown from Agrost. No. 1199-1.

AMHERST.

A rather low and stocky, well-branched variety, with large leaves and broad pods. Stems medium to stout, one-fourth to seven-sixteenths inch in thickness, 12 to 24 or 30 inches high; branches not numerous, ascending or appressed, the lower nearly as long as the stem and arising from very near its base; leaves very broad and large, medium green in color; pods very large, 1½ to 2¼ inches long, one-half inch broad, 2 or 3 seeded, borne on stem and branches almost to the ground. The seeds are large, spherical, 7 to 9 mm. in diameter, often scarcely flattened in dorsal view, deep yellow with a slight greenish tinge, becoming paler and duller with age; hilum yellow or brownish.

The time required for the Amherst variety to reach maturity varies from one hundred and five to one hundred and thirty days, the average being about one hundred and fifteen to one hundred and twenty days. It ripens a few days later than the Guelph variety, which it somewhat resembles except in being considerably smaller. It has been grown successfully in the Northern States and is reported as a fair to good yielder. Tests at Washington, D. C., have given from 5 to more than 20 bushels to the acre; the Kansas Agricultural Experiment Station reports 10 bushels, while the Kentucky station quotes yields of from 26 to 40 bushels to the acre.

It will be noted that the greenish tinge on the seeds indicates the relationship of this with the three greenish yellow varieties. Inspection of the tables will show that it lies between Yosho and Haberlandt in size and maturity, and rather nearer to the latter in both. In habit it is also very near Haberlandt.

This variety was named for the Massachusetts Agricultural Experiment Station, at Amherst, Mass., where soy beans have been cultivated for many years from specially imported seed.

Numbers and sources of lots grown.—Agrost. No. 452, grown from S. P. I. No. 4913; Agrost. No. 1170, S. P. I. No. 9408; Agrost. No. 1296, S. P. I. No. 6336; S. P. I. No. 4913, "Best White;" S. P. I. No. 5765, grown from S. P. I. No. 4913; S. P. I. No. 6336, "Bakaziro," Japan; S. P. I. No. 8494, grown from S. P. I. No. 6336; S. P. I. No. 9408, grown from S. P. I. No. 5765; S. P. I. No. 9413, grown from S. P. I. No. 6336; S. P. I. No. 12400, grown from S. P. I. No. 9408; S. P. I. No. 17275, grown from Agrost. Nos. 1170-2 and 1296-2.

HOLLYBROOK.

A fairly large, medium late variety, with long appressed or ascending branches. Stems fairly stout, one-fourth to three-eighths or one-half inch in diameter at the base, 20 to 36 inches tall, 25 to 30 inches representing the average height; branches nearly as long as the main stem, appressed or ascending; leaves large, medium green in color, pods quite thickly set on stem and branches, medium in size, 1 to 1½ inches long, three-eighths inch wide, mostly 2 seeded. Seeds medium in size, 6 to 7 mm. wide, 6 to 8 mm. long, some spherical, mostly broadly elliptical, somewhat flattened in dorso-ventral view, deep or lemon yellow, very shiny, becoming paler and duller with age; hilum usually pale brown.

For the most part this variety has been too late to mature in the Northern States, though it has been called early in Massachusetts and Rhode Island in a favorable season. It requires from one hundred and ten to one hundred and thirty-five days to reach maturity, the average being about one hundred and twenty days. Yields of 5, 9, and 20 bushels to the acre have been secured at Washington, and still better yields at some other points. This variety should make a good hay and silage crop where sown somewhat thickly. When thinly sown it has a tendency to become top-heavy and to lodge somewhat.

The Hollybrook variety was originated by Messrs. T. W. Wood & Sons, of Richmond, Va., as an early selection from Mammoth Yellow. The name "Hollybrook" was given it by them, and is the name of the seed farm on which the variety originated.

Numbers and sources of lots grown.—Agrost. No. 454, grown from S. P. I. No. 4912; Agrost. No. 976, S. P. I. No. 6556; Agrost. No. 1169, S. P. I. No. 9407; Agrost. No. 1196, S. P. I. No. 3870; Agrost. No. 1299, from Havre, France; Agrost. No. 1538, S. P. I. No. 6379; Agrost. No. 2032, "Hollybrook," Arkansas Agric. Exp. Station; S. P. I. No. 3870, China; S. P. I. No. 4912, "Common soy," Japan; S. P. I. No. 5764, grown from S. P. I. No. 4912; S. P. I. No. 6379, grown from S. P. I. No. 3870; S. P. I. No. 6556, "The most common soy," China; S. P. I. No. 9407, grown from S. P. I. No. 4912; S. P. I. No. 12399, grown from S. P. I. No. 9407; S. P. I. No. 17269, grown from Agrost. No. 976-2; S. P. I. No. 17270, grown from Agrost. No. 1169-2; S. P. I. No. 17272, grown from Agrost. No. 1538-1; S. P. I. No. 17276, grown from Agrost. No. 1299-1 and 1299-2; S. P. I. No. 17278, grown from Agrost. No. 2032.

MAMMOTH.

The Mammoth is the best known and most widely cultivated variety in the Southern States. It has also been sold to a considerable extent in the North, mostly because of the splendid growth it makes, but it has never given satisfaction there because of its lateness. It has been a commercial variety in this country for a great many years, but its origin is not known. None of the varieties yet imported by this Department has proved to be exactly the same form. The Hollybrook is the most closely related, but differs in its considerably lower growth and in being a little earlier also. The Mammoth is the largest variety here discussed, though not quite so tall as the Riceland and Hankow.

The main stems are from one-fourth to more than one-half inch in diameter at the base, from 24 or 30 to fully 48 inches in height, well branched from quite near the base, with long, ascending branches, the lower ones from 1½ to 2 feet long, the leaves very large, usually rather more pointed than in the other large-leaved varieties, medium to dark in color; pods 1 to 1½ inches long, three-eighths to seven-sixteenths inch wide, 2 or often 3 seeded, scattered over the stem and long branches; the seeds are medium in size, 6 to 6½ mm. wide, 6 to 7½ or 8 mm. long, spherical or broadly oblong in outline, somewhat flattened, bright lemon-yellow, shining, becoming paler and duller with age; hilum usually pale brown.

The time required to reach maturity varies from one hundred and ten to one hundred and forty days, the average being one hundred and twenty and one hundred and thirty days. The yields of 17 plats at Washington varied between 4⅔ and 15 bushels to the acre, with an average of 9½ bushels.

The name, Mammoth, is very suitable for this variety, and is coming into use for it in the agricultural press and by some seedsmen.

Numbers and sources of lots grown.—Agrost. No. 1195, "Yellow," S. P. I. No. 4285, Virginia; Agrost. No. 1300, "Late," F. Barteldes & Co.; Agrost. No. 1305, T. W. Wood & Sons; Agrost. No. 1307, "Southern," T. W. Wood & Sons; Agrost. No. 1308, Iowa Seed Co.; Agrost. No. 1309, Johnson & Stokes; Agrost. No. 1310, Plant Seed Co.; Agrost. No. 1311, C. J. McCullough; Agrost. No. 1314, "Late Yellow," Peter Henderson & Co.; Agrost. No. 1315, Northrup, King & Co.; Agrost. No. 1465, "Yellow," Breck & Sons; Agrost. No. 1466, "Yellow," Texas Seed and Floral Co.; Agrost. No. 1472, "Southern," J. M. Thorburn & Co.; Agrost. No. 1477, Hammond Seed Co.; Agrost.

No. 1976, union of seven of above serial numbers; Agrost. No. 1977, union of seven of above serial numbers; S. P. I. No. 4285, "Yellow," T. W. Wood & Sons; S. P. I. No. 17280, grown from Agrost. Nos. 1976 and 1977.

LIST OF SYNONYMS.

The following is a list of the names under which soy beans have been received from experiment stations, seedsmen, and growers in the United States. It includes all the important names under which varieties have been sold or written about in the agricultural press, seed catalogues, and experiment station bulletins. After each such name is given the name under which the variety is described in this bulletin.

Adzuki	Ito San.	Kaiyuski Daizu	Ito San.
Black	Buckshot.	Kiyusuki Daidzu	Ito San.
Brown Eda Mame	Eda.	Kysuki	Ito San.
Crossbred No. 6	Ogemaw.	Large Black	Buckshot.
Early Black	Buckshot.	Late Yellow	Mammoth.
Early Green	Guelph.	Mammoth Yellow	Mammoth.
Early Japan	Butterball.	Medium Black	Buckshot.
Early White	Ito San.	Medium Early Black	Buckshot.
Early Yellow	Ito San.	Medium Early Green	Guelph.
Extra Early Black	Buckshot.	Medium Green	Guelph.
Green	Guelph.	Ogema	Ogemaw.
Green Samarow	Samarow.	Southern	Mammoth.
Hollybrook	Hollybrook.	Yellow	Mammoth.
Ito San	Ito San.	Yellow Eda Mame	Ito San.
Japanese No. 15	Kingston.		

DISTRIBUTION NUMBERS.

The following are the serial numbers under which soy beans were distributed by the former Division of Agrostology, with the name of the variety to which each has been referred:

452. Amherst.
454. Hollybrook.
468. Tokyo.
658. Ito San.
696. Tokyo.
912. Guelph.
964. Riceland.
969. Guelph.
972. Hankow.
976. Hollybrook.
1169. Hollybrook.
1170. Amherst.
1171. Tokyo.
1183. Ito San.
1184. Buckshot
1185. Eda.
1186. Ito San.
1187. Ito San.
1188. Kingston.
1189. Ito San.
1192. Ito San.
1193. Ebony.
1194. Haberlandt.
1195. Mammoth.
1196. Hollybrook.
1197. Butterball.
1198. Tokyo.
1199. Butterball.
1200. Tokyo.
1292. Buckshot.
1293. Flat King.
1294. Ito San.
1295. Manhattan.
1296. Amherst.
1297. Yosho.
1298. Tokyo.
1299. Hollybrook.
1300. Mammoth.
1301. Buckshot.
1302. Samarow.
1303. Buckshot.
1304. Buckshot.
1305. Mammoth.
1306. Guelph.
1307. Mammoth.
1308. Mammoth.
1309. Mammoth.
1310. Mammoth.
1311. Mammoth.
1312. Guelph.
1313. Ito San.
1314. Mammoth.
1315. Mammoth.
1316. Ito San.

1464. Guelph.
1465. Mammoth.
1466. Mammoth.
1467. Guelph.
1468. Ito San.
1469. Guelph.
1470. Samarow.
1471. Buckshot.
1472. Mammoth.
1473. Guelph.
1474. Buckshot.
1475. Ito San.
1476. Guelph.
1477. Mammoth.
1478. Ito San.
1536. Nuttall.
1538. Hollybrook.
1539. Haberlandt.
1540. Haberlandt.
1541. Ebony.
1542. Brownie and Baird.
1764. Guelph.
1765. Ito San.
1971. Guelph.
1972. Samarow.
1973. Ito San.
1974. Ito San.
1975. Ito San.
1976. Mammoth.
1977. Mammoth.
1978. Buckshot.
1979. Buckshot.
1980. Ebony.
1992. Ogemaw.
2031. Ogemaw.
2032. Hollybrook.
2033. Buckshot.

The following is a list of the serial numbers under which soy beans have been distributed by the Office of Seed and Plant Introduction and Distribution, with the name of the variety to which each is referred in this bulletin. Several S. P. I. numbers representing soy beans not studied by the writer are not included in the list.

3870. Hollybrook.
4285. Mammoth.
4912. Hollybrook.
4913. Amherst.
4914. Tokyo.
5764. Hollybrook.
5765. Amherst.
5766. Tokyo.
6312. Flat King.
6314. Yosho.
6326. Ito San.
6333. Manhattan.
6334. Buckshot.
6335. Tokyo.
6336. Amherst.
6379. Hollybrook.
6386. Ebony.
6396. Haberlandt.
6397. Haberlandt.
6414. Brownie and Baird.
6416. Nuttall.
6556. Hollybrook.
6558. Guelph.
6559. Hankow.
6560. Riceland.
8422. Butterball.
8423. Tokyo.
8424. Tokyo.
8489. Yosho.
8490. Manhattan.
8491. Buckshot.
8492. Ebony.
8493. Haberlandt.
8494. Amherst.
8495. Haberlandt.
8496. Nuttall.
8497. Flat King.
9344. (Probably Hankow.)
9407. Hollybrook.
9408. Amherst.
9409. Tokyo.
9410. Flat King.
9411. Manhattan.
9412. Buckshot.
9413. Amherst.
9414. Ebony.
9415. Haberlandt.
9416. Haberlandt.
9417. Brownie and Baird.
9418. Nuttall.
11179. Buckshot.
12399. Hollybrook.
12400. Amherst.
13502. Ogemaw.
13503. Guelph.
16790. (Probably Riceland.)
17251. Buckshot.
17252. Flat King.
17253. Nuttall.
17254. Ebony.
17255. Kingston.
17256. Brownie and Baird.
17257. Eda.
17258. Ogemaw.
17259. Ogemaw.
17260. Samarow.
17261. Guelph.
17262. Yosho.
17263. Haberlandt.
17264. Tokyo.
17265. Tokyo.
17266. Tokyo.
17267. Tokyo.
17268. Ito San.
17269. Hollybrook.
17270. Hollybrook.
17271. Haberlandt.
17272. Hollybrook.
17273. Butterball.
17274. Butterball.
17275. Amherst.
17276. Hollybrook.
17277. Manhattan.
17278. Hollybrook.
17280. Mammoth.
17852. Meyer.

THE PHILADELPHIA JUL 12 1907 MUSEUMS

PLATES.

98 29

DESCRIPTION OF PLATES.

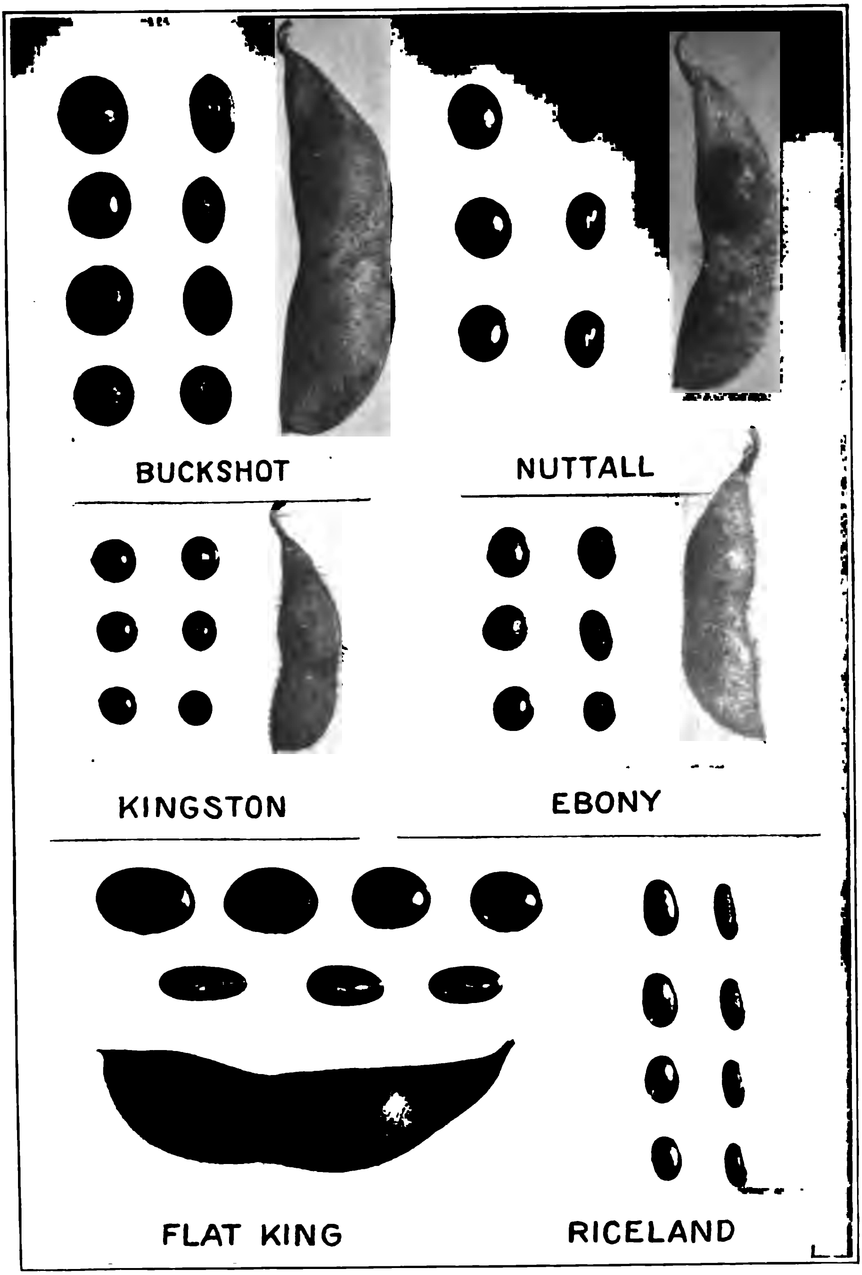
Plate I. *Frontispiece.* Seeds of all varieties of soy beans in natural sizes and colors. Black-seeded group: 1.—Buckshot. 2.—Nuttall. 3.—Kingston. 4.—Ebony. 5.—Flat King. 6.—Riceland; one seed washed, one with bloom. 6*a*.—A larger undetermined soy bean from Italy. Brown-seeded group: 7.—Ogemaw. 8.—Eda, showing different shades of color. 9.—Baird and Brownie (the two left-hand seeds, Baird; the right-hand seed, Brownie). Mottled-seeded group: 10.—Meyer. 11.—Hankow; one seed washed, one with bloom, one in dorsal view. Green-seeded group: 12.—Samarow. 13.—Guelph. 14.—Yosho; one lateral view, one ventral view showing hilum. 15.—Haberlandt; one lateral view, one ventral view showing hilum. 16.—Tokyo; one lateral view, one ventral view showing hilum. Yellow-seeded group: 17.—Ito San. 18.—Manhattan. 19.—Butterball. 20.—Amherst. 21.—Hollybrook. 22.—Mammoth.

Plate II. Seeds and pods of the black-seeded group. Seeds of different sizes in lateral and ventral (or hilum) view, and pods in lateral view: Buckshot, Nuttall, Kingston, Ebony, Flat King, Riceland, and a larger undetermined soy bean from Italy.

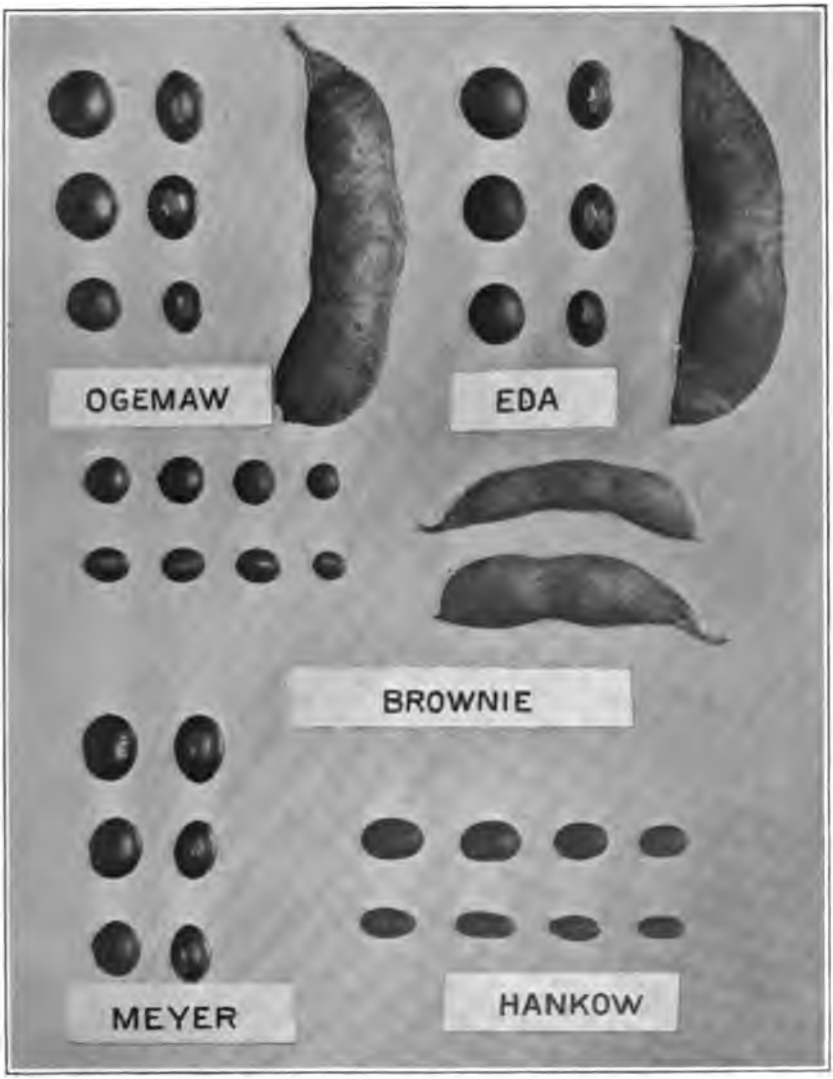
Plate III. Seeds and pods of the brown-seeded and mottled-seeded groups. Seeds of different sizes in lateral and ventral (or hilum) view, and pods in lateral view: Ogemaw, Eda, Baird and Brownie (the four right-hand seeds and the upper pod, Brownie; the four left-hand seeds and the lower pod, Baird), Meyer, Hankow.

Plate IV. Seeds and pods of the green-seeded and greenish-yellow-seeded groups. Seeds of different sizes in lateral and ventral (or hilum) view, and pods in lateral view: Samarow, Guelph, Yosho, Haberlandt, Tokyo.

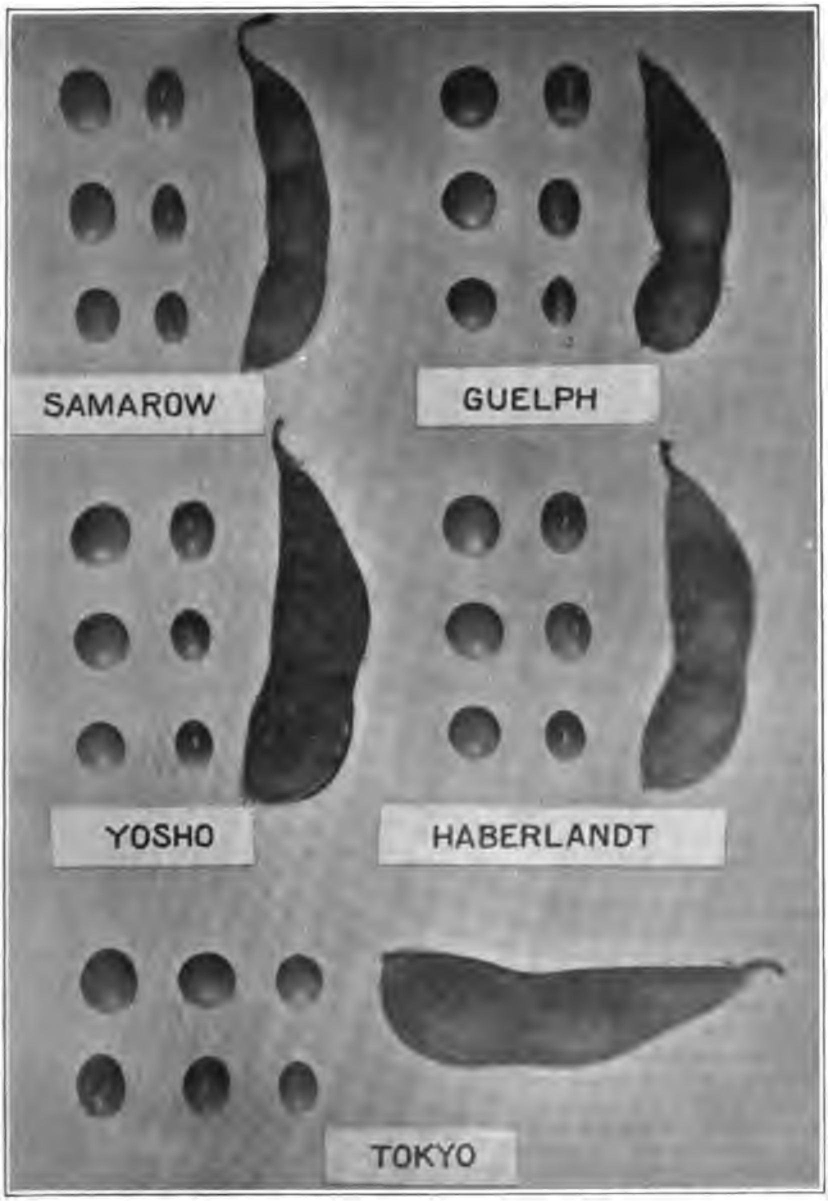
Plate V. Seeds and pods of the yellow-seeded group. Seeds of different sizes in lateral and ventral (or hilum) view, and pods in lateral view: Ito San, Manhattan, Butterball, Amherst, Hollybrook, Mammoth.



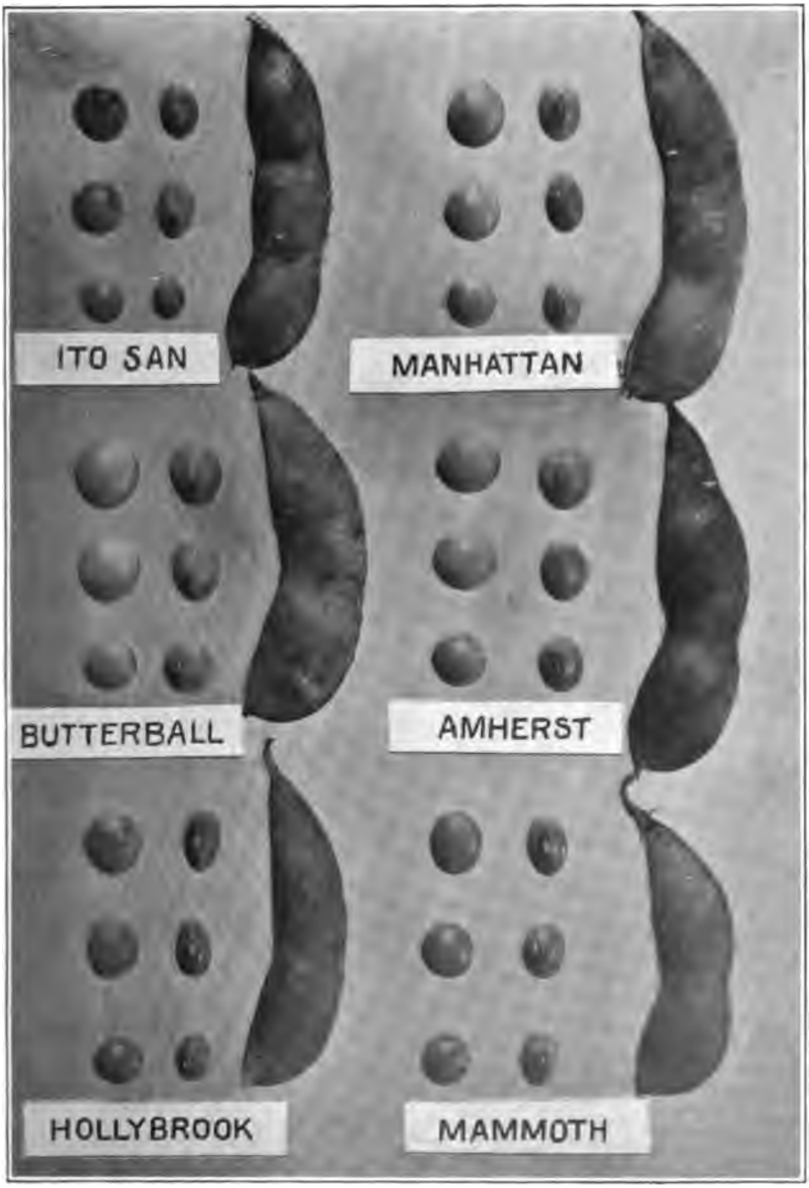
SEEDS AND PODS OF THE BLACK-SEEDED GROUP.



SEEDS AND PODS OF THE BROWN-SEEDED AND MOTTLED-SEEDED GROUPS.



SEEDS AND PODS OF THE GREEN-SEEDED AND GREENISH-YELLOW-SEEDED GROUPS.



SEEDS AND PODS OF THE YELLOW-SEEDED GROUP.

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MUSEUMS

U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 99.

B. T. GALLOWAY, *Chief of Bureau.*

A QUICK METHOD FOR THE DETERMINATION OF MOISTURE IN GRAIN.

BY

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Botanist in Charge of the Seed Laboratory.

AND

J. W. T. DUVEL,
Assistant in the Seed Laboratory.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
OFFICE OF THE CHIEF,
Washington, D. C., November 3, 1906.

SIR: I have the honor to transmit herewith a manuscript entitled "A Quick Method for the Determination of Moisture in Grain," and to recommend that it be published as Bulletin No. 99 of the series of this Bureau.

By means of the method and apparatus described it is possible to make complete moisture determinations of grain in from 20 to 25 minutes. This makes it practicable in commercial work to include a definite statement of the moisture content among the factors determining quality.

This paper was prepared by Mr. Edgar Brown, botanist in charge of the Seed Laboratory, and Dr. J. W. T. Duvel, assistant in the Seed Laboratory. The illustrations which accompany it are necessary to a full understanding of the text.

Respectfully,

B. T. GALLOWAY,
Chief of Bureau.

HON. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

Page.
uality of export corn ... 7
auses of deterioration ... 7
he percentage basis for moisture determinations ... 8
escription of a method for the rapid determination of moisture ... 9
reparation of samples for moisture determination ... 10
  Taking the bulk sample ... 10
  Taking the sample for the moisture test ... 10
  Size of sample for the moisture test ... 11
  Weighing the sample for the moisture test ... 11
  Grinding the grain unnecessary ... 12
il for the moisture test ... 12
  Quality required ... 12
  Quantity required ... 13
escription of the apparatus ... 13
  The evaporating chamber ... 13
  The condenser ... 18
  The stand supporting the evaporating chamber and condenser ... 18
  The distillation flasks ... 19
  The thermometers ... 20
  The condenser tubes ... 20
  The graduated cylinders for collecting and measuring the water ... 20
omparison of results with determinations made in a water oven ... 21
  Variations in duplicate tests ... 22
ummary ... 23

ILLUSTRATIONS.

		Page.
Fig. 1.	Balance for weighing grain samples	9
2.	Aluminum weighing pan for transferring grain samples to the distillation flasks	11
3.	Plan of front of apparatus for moisture determination	14
4.	Plan of back of apparatus for moisture determination	15
5.	Plan of end of apparatus for moisture determination	16
6.	Front view of apparatus for moisture determination	17
7.	Back view of apparatus for moisture determination	17
8.	End view of apparatus for moisture determination	18
9.	Interior arrangement of the compartments of the evaporating chamber, showing the position of the triangle over the gauze	19
10.	Distillation flask	19
11.	Condenser tube	20
12.	Graduated cylinders for measuring the water expelled from the grain.	21

B. P. I.—240.

A QUICK METHOD FOR THE DETERMINATION OF MOISTURE IN GRAIN.[a]

QUALITY OF EXPORT CORN.

During the past few years the commercial grading of corn has been a matter of much controversy, both in the United States and in Europe. Complaints of the poor condition of corn on arrival at European ports have been constantly increasing, corn inspected at American ports as No. 2, or "prime sail," having proved in many cases unfit for feeding purposes when discharged at foreign ports. This uncertainty as to quality has already led European buyers to purchase largely from other corn-growing countries, and unless the quality of corn exported from the United States is improved our foreign trade must inevitably suffer. Last year the total quantity of corn imported into France (general trade) was, in round numbers, twelve and three-fourths million bushels, of which the United States furnished only 20.9 per cent, or approximately two and two-thirds million bushels, while Argentina alone supplied 64.4 per cent, or approximately eight and one-fourth million bushels.

CAUSES OF DETERIORATION.

The principal cause of the deterioration of corn during transit or in storage is an excessive amount of moisture. Corn as it is harvested in the autumn ordinarily contains from 20 per cent to 35 per cent of water, depending on the season and the relative time of harvesting. Much of the corn as it comes from the fields goes directly into the small elevators thruout the corn-growing States, to be transferred later to the large elevators or storage bins at the grain centers. Owing to the cold weather usually prevalent at this season of the year, corn may be stored or exported without much danger of deterioration, even tho the water content is relatively high, but with a slight rise in temperature it will begin to sweat, after which fermentation soon sets in, resulting in moldy and damaged grain.

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[a] Application has been made for a patent on the apparatus described in this bulletin, in order that it may be used or manufactured by any person in the United States without the payment of royalty.

With the present system of grain inspection, when hundreds of cars must be inspected daily, and the water content of the corn is determined only by feeling the corn with the hand or by biting the kernels, any degree of accuracy is next to impossible. Most of this work is done in the cars on the track and sometimes when the mercury has gone below the zero mark.

THE PERCENTAGE BASIS FOR MOISTURE DETERMINATIONS.

There seems to be a growing demand among grain men and inspection departments for a more definite and uniform system of grading, which is taking the form of an agitation for uniform rules for grades. Any system of uniform grading to be effective must be based on a percentage statement of the various factors which go to make up the quality and condition of any particular lot of grain in order to insure uniformity of application. With this in view, a considerable amount of preliminary work has been done for several years in the Bureau of Plant Industry, which will later aid in formulating rules to place the grading of grain on a basis which will permit stating the elements of condition and quality in definite terms.

Members of boards of trade and chambers of commerce, as well as most grain inspectors, have been much in doubt as to the practicability of incorporating in their rules a percentage statement of moisture in grain, and with the methods commonly employed for making moisture determinations the percentage system is not suitable to the present condition of the grain trade, save, perhaps, in a few special cases. Heretofore the minimum time required to make a moisture determination of a sample of grain was from six to eight hours, and this was accomplished by drying a carefully weighed ground sample in a glycerin oven or in a vacuum at a temperature of 105° or 108° C. If the drying be done in an ordinary water oven, such as is commonly used, the time must be extended to from sixteen to twenty hours. To each of these periods must be added the time occupied in grinding and weighing the sample preparatory to drying, and likewise the time required for the samples to cool in the desiccator before the final weighing. If whole kernels are used instead of a ground sample, the time required by the process at present in use must be extended to from sixty to ninety-six hours.

But, disregarding the time factor, the method outlined is not applicable to commercial corn containing a relatively large percentage of water. Practically all of the machines available for grinding samples of grain for analysis are of the "burr" type, and during the grinding the temperature of the grain is increased to such an extent that from 0.5 per cent to 1.5 per cent of moisture is lost in the process of grinding, unless the corn has been well cured and dried, in which case a moisture determination is not needed.

It has therefore become necessary to devise some suitable method and apparatus for determining the amount of water in corn and other grains before any hope of placing the grading of grain on a percentage basis can be entertained seriously at any of our large grain centers. It is hoped that the method described in the following pages, which is applicable to the testing of wheat and other grains as well as corn, will be sufficiently rapid and easy to make it of practical value to the grain trade, and possibly to other industries.

DESCRIPTION OF A METHOD FOR THE RAPID DETERMINATION OF MOISTURE.

The fundamental principle[a] on which this method of moisture determination is based consists in heating whole grains in oil to a temperature considerably above that of boiling water and thus driving out the water, which is afterwards condensed and measured in a graduated flask. With this method it is possible to determine the percentage of water in a sample of corn in from twenty to twenty-five minutes.

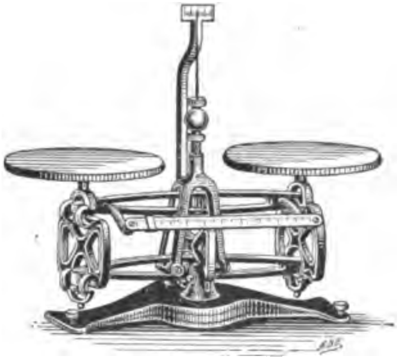

FIG. 1.—Balance for weighing grain samples.

One hundred cubic centimeters of a good grade of hydrocarbon oil are measured and poured into a glass distillation flask (see fig. 10). One hundred grams of corn are weighed on a torsion balance similar to the one shown in figure 1, the corn being emptied at once into the flask containing the oil. The neck of the flask is closed with a good rubber stopper carrying a thermometer, the bulb of which should extend well into the mixture of oil and corn. The side of the flask is then connected with a condenser by means of a second rubber stopper. With a strong gas burner the corn in the oil bath is then heated until the thermometer registers 190° C. (374° F.), at which time the flame is extinguished. The time required for the temperature to reach 190° C. will be from ten to fifteen minutes, depending on the amount of water in the corn and on the volume of the flame. Eight or ten minutes after the flame has been removed the water will have ceased dropping from the condenser, and the number of cubic centimeters of water contained in the graduated cylinder beneath the condenser tube can be ascertained. This is the water actually removed from the corn and represents the percentage of moisture originally in the sample, each cubic centimeter of water representing 1 per cent when a 100-gram sample is used. By the use of this method, together with the special apparatus described in this bulletin, a person familiar with laboratory work and an assistant should be able to make at least 200 moisture determinations in a day of eight hours.

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[a] This principle has already been described by Dr. J. F. Hoffmann in Zeitschrift für Angewandte Chemie, Berlin, 1902, p. 1193, and in the Grain Dealers' Journal, Chicago, May, 1906, p. 526. However, the apparatus used by Hoffmann and likewise the details of the method described by him have proved unsuitable where large numbers of samples are to be analyzed. Consequently, in August, 1905, experiments were begun to simplify the Hoffmann method and to devise an apparatus which would prove practical for laboratories handling a large number of samples of grain.

PREPARATION OF SAMPLES FOR MOISTURE DETERMINATION.

TAKING THE BULK SAMPLE.

Care in drawing the bulk sample from the car, cargo, conveyer, etc., is of the utmost importance and can not be too strongly emphasized, for unless this part of the work is properly done the true percentage of moisture in the grain can not be determined.

The samples should be taken in such a way as to represent as nearly as possible the condition of the entire lot of grain under consideration, and in this respect the method herein described does not differ from any other system of inspection. The number of samples to be drawn from different parts of the bulk will depend upon the quantity and quality of the grain to be past upon. The larger samples so drawn may be analyzed separately or they may be mixt together to form one composite sample representing the entire bulk and the smaller samples for the individual moisture determinations taken from this mixture, as the conditions may warrant. If the bulk of corn being examined is of uniform quality, a moisture determination of the composite sample will suffice; but if the bulk lacks uniformity, and particularly if of a low grade, the samples taken from different parts of the grain under consideration or at different times during the "running" should be analyzed separately. At the same time the amount of grain represented by each sample should be estimated. But whatever samples are intended for moisture determination must be put at once into a suitable air-tight container in order to prevent any drying of the grain on being exposed to the air; otherwise the amount of moisture actually present can not be accurately determined. This precaution is particularly important in the case of samples drawn from any bulk lot of grain which has begun to sweat.

TAKING THE SAMPLE FOR THE MOISTURE TEST.

The accuracy of any method of determining moisture depends primarily on the small sample used for the test being thoroly representative of the bulk sample. In order that the small sample may be representative, the bulk sample should be thoroly mixt and small portions taken from different parts of it. The greatest accuracy can be secured thru the use of some form of mechanical mixer and sampler, and the one shown on pages 12 and 13 of Circular 34, Revised, Office of Experiment Stations, modified so as to be adapted for larger grain, is recommended.

SIZE OF SAMPLE FOR THE MOISTURE TEST.

The size of the sample to be taken for the individual moisture test may be varied, but experience has shown that 100 grams of whole kernels give the most satisfactory results, which quantity has therefore been established as the standard for the method and apparatus for testing corn herein described. This is a sufficiently large quantity to insure the securing, without difficulty, of a representative sample. Moreover, when samples containing 100 grams are used, every cubic centimeter of water expelled from the grain represents 1 per cent of moisture, and the readings in the graduated cylinders are in percentages as well as in volume, thereby reducing the chances of error to a minimum.

WEIGHING THE SAMPLE FOR THE MOISTURE TEST.

In making moisture determinations according to the method outlined in the foregoing pages, the use of delicate analytical balances is obviated. An ordinary torsion balance similar to the one shown as figure 1, which is sensitive to one-thirtieth of a gram and can be purchased for about $15, will serve every purpose. A more delicate balance is entirely unnecessary when it is remembered that one kernel of corn weighs approximately one-third of a gram. The scale pans are 6 inches in diameter, and the side beam shows 5 grams, graduated in one hundred divisions, each one-twentieth of a gram, and the total capacity of the balances is 2 pounds, or 907 grams. Balances of this kind are easily operated, and the time consumed in the weighing need not be longer than that required for the pharmacist to weigh out the prepared drugs for his medicines.

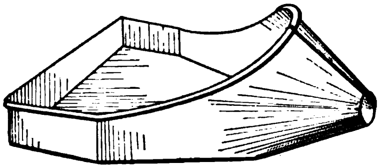

FIG. 2.—Aluminum weighing pan for transferring grain samples to the distillation flasks.

A specially constructed scale pan, such as is shown as figure 2, should be secured to facilitate the transferring of the weighed samples to the distillation flasks, the opening in the end of the scoop being of the same size as the neck of the flasks—1 inch. If made of light material, preferably aluminum, a scoop of this kind need not weigh more than 50 or 75 grams and can be substituted for one of the scale pans or used with a counterpoise. The scoop should be about 4 inches wide.

GRINDING THE GRAIN UNNECESSARY.

The whole kernels are used for making the moisture determination, thus doing away with the preliminary grinding of the samples; in fact, the method described is not applicable, without some modification, to samples of ground grain. Ground samples have a tendency to cake in the bottom of the flask and prevent a free circulation of the oil, with a corresponding variation in the temperature at different points in the sample of meal, and the results obtained are not reliable. Moreover, the grinding of samples for the determination of moisture in commercial grain is always to be avoided. Grain of this character generally contains a high percentage of moisture, and with the "burr" type of mill usually used for grinding samples of this kind the friction developed during the grinding causes a rise in temperature and a corresponding loss of moisture. This loss of moisture increases as the water content of the grain increases, and in samples of grain which have begun to sweat this loss is frequently as much as 1½ per cent.

OIL FOR THE MOISTURE TEST.

QUALITY REQUIRED.

In securing an oil suitable for the bath in which the corn is to be heated, five primary factors must be taken into consideration:

(1) The oil must be free from water.

(2) It must be an oil having a comparatively low viscosity, so that it will run freely at ordinary room temperature.

(3) The flash point must be sufficiently high to avoid danger of an explosion or fire.

(4) The saponification value should be zero.

(5) The oil must be cheap.

Experiments have demonstrated that any of the pure hydrocarbon oils showing a composition within the range of the two samples indicated below will give satisfactory results:

	No. 1.	No. 2.
Specific gravity at 15.5° C	0.9095	0.8957
Viscosity at 20° C. (Engler)	19.2	6.2
Flash point (open cup) degrees centigrade	205	175
Fire point (open cup) do	245	210
Saponification value	None.	None.

An oil similar to sample No. 1 is to be preferred to sample No. 2, owing to the difference in the flash point, altho the latter may be used with safety if the necessary precautions are taken to prevent the temperature running too high; however, an oil with a flash point as low as 175° C. in an open cup is not to be recommended for general use. An oil with a flash point of from 200° to 205° C. (open cup) and a viscosity of 10 or 15 at 20° C. (Engler) is more desirable. Oils of this character are found among many grades of lubricating oils, especially those known as "engine oils," and can be purchased in barrel lots for about 12½ or 15 cents a gallon.

As the moisture is liberated from the grain the foaming of the oil will be quite pronounced, and the flask must be sufficiently large to prevent the foaming oil from being carried over into the condenser tube. The foaming can be greatly reduced by the addition of from 15 to 20 per cent of paraffin, but this is usually unnecessary.

QUANTITY REQUIRED.

The quantity of the oil in the distillation flask admits of a wide variation, it being only necessary to have such a quantity of oil that all of the grain used for the test will be immersed. One hundred grams of corn require approximately 100 cubic centimeters of oil; while if only 50 grams of grain are used the quantity of oil can be reduced. The quantity of oil used, however, is not an important factor, inasmuch as the greater part of it can be recovered by emptying the contents of the flask into a colander at the close of the test and allowing the oil to drain off. The oil so recovered can be used again with equally as good results as with fresh oil. But even if the oil is not used a second time, 1 gallon, costing 12½ or 15 cents, is sufficient for forty tests.

DESCRIPTION OF THE APPARATUS.

In devising the apparatus for making moisture determinations in accordance with the method outlined in these pages, the principal aim has been to secure an apparatus suitable for laboratories engaged in determining the percentage of water in samples of commercial grain. The following description and the accompanying illustrations (figs. 3, 4, 5, 6, 7, and 8) show the detailed construction of the apparatus.

THE EVAPORATING CHAMBER.

For the want of a better term the name "evaporating chamber" has been applied to that part of the apparatus in which the samples of corn immersed in the oil are heated. (See figs. 4 and 5.) The evaporating chamber (*B*) is made of a good quality of galvanized iron and is divided into six compartments, as shown in figure 4.

A six-compartment chamber is here described, it being the best for ordinary work; however, the apparatus can be made with a single compartment or with a dozen or more, if so desired. Each of the compartments is lined thruout with heavy asbestos. In addition to the asbestos lining the front of the chamber—the wall next to the condenser—is covered with heavy asbestos on the outside.

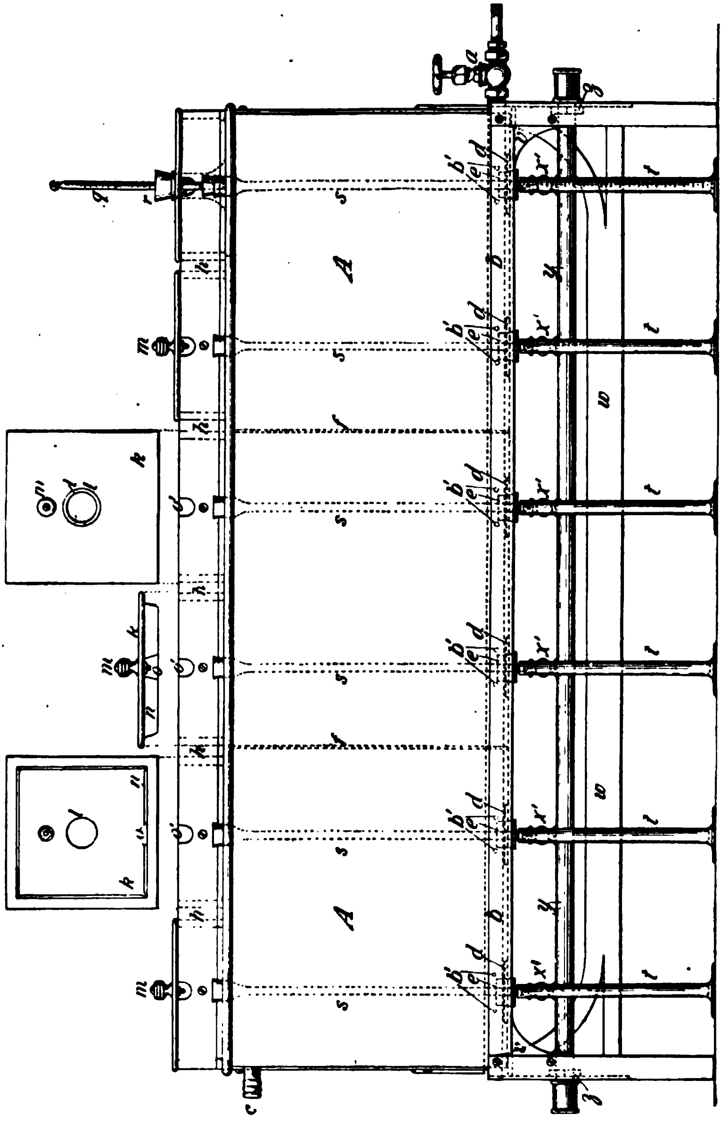

Fig. 3.—Plan of front of apparatus for moisture determination.

A, condenser; *a*, valve on cold-water pipe; *b*, water pipe along bottom of tank; *b′*, diagonal holes in pipe opening into tank; *c*, overflow pipe; *d*, heavy washers; *e*, rubber stoppers supporting condenser tubes; *f*, braces on sides of tank; *h*, air space between compartment partitions in evaporating chamber; *k*, covers; *l*, hole in cover for neck of flask; *m*, wooden handle on cover; *n*, flange on cover; *o*, notch in flange; *o′*, notch in front of evaporating chamber; *q*, thermometer in flask; *r*, rubber stopper supporting thermometer; *s*, glass condenser tubes; *t*, graduated measuring cylinders; *v*, braces on stand; *w*, cross piece on back of stand; *x′*, extra stopcock at base of burner; *y*, gas pipe; *z*, nuts for adjusting height of gas pipe.

The front of the evaporating chamber and the two ends (figs. 4 and 5) rest on an iron stand (*C*), while the wall at the back of the chamber extends only to the line *u u'*, which is 5 inches above the base. (See fig. 4.) This side is left partially open to facilitate the lighting of the burners and to give a better supply of air. A 2-inch hole should likewise be cut in each end of the apparatus about 4½ inches from the base, in order to give a greater supply of air to the two end burners; this, however, is not shown in the illustrations.

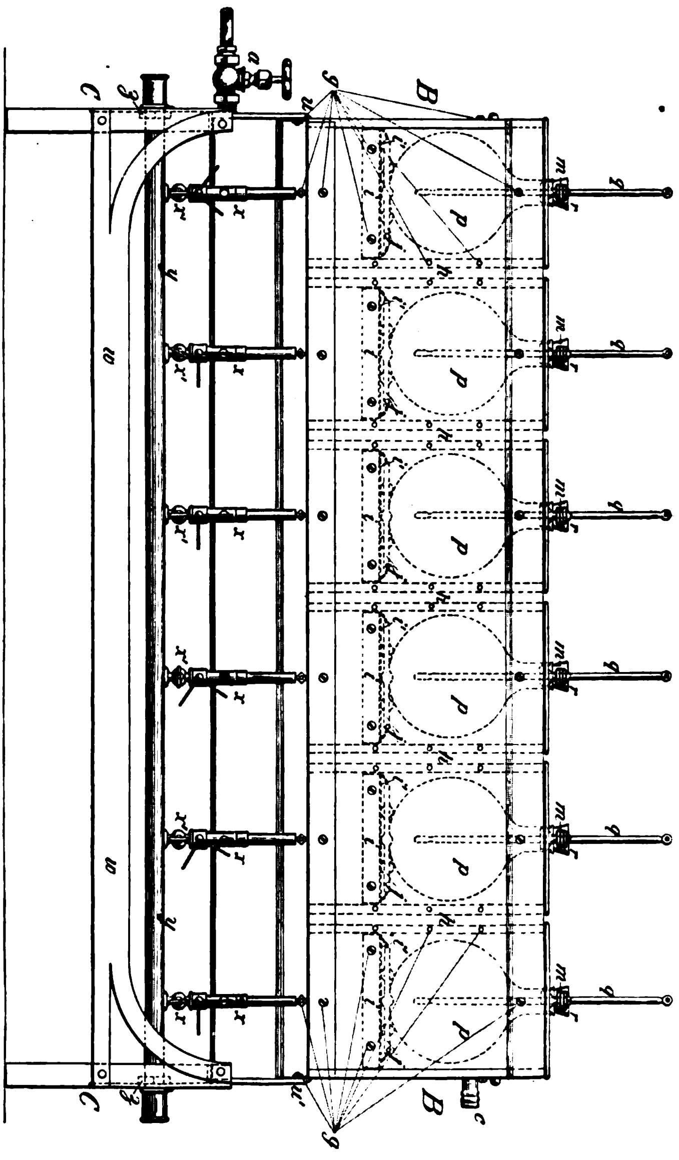

FIG. 4.—Plan of back of apparatus for moisture determination.

B, evaporating chamber; *C*, stand supporting evaporating chamber and condenser; *a*, valve on water pipe; *c*, overflow pipe; *g*, screw bolts; *h*, air space between partitions; *i*, ledge supporting gauze, triangle, and flasks; *i'*, galvanized iron ring above wire gauze; *j*, flanged pipestem triangle; *m*, wooden handle on covers; *p*, distillation flasks; *q*, thermometers in flasks; *r*, rubber stopper carrying thermometers; *u u'*, lower line of outside wall of evaporating chamber; *w*, cross-piece on back of stand; *x*, burners; *x'*, extra stopcock beneath burners; *y*, gas pipe; *z*, nuts for adjusting gas pipe.

The different parts of the evaporating chamber, including the asbestos lining and covering, are fastened together with the screw bolts (figs. 4 and 5, *g*). The different compartments are each made 5⅝ inches square inside, and are separated from each other by two partitions, each with a double thickness of asbestos, and a quarter-inch air space (*h*), so that when the heat is turned off from one compartment the sample of corn in the flask within will in no way be affected by the heat from an adjoining compartment should it still be in operation. These partitions extend 2½ inches below the ledges (*i*) which support the flasks (*p*), in order to prevent the flame of any one burner from spreading into an adjoining compartment. Within each compartment, 6½ inches from the top of the chamber, is a galvanized-iron ledge (*i*) for supporting the wire gauze, flask, etc., the ledge being cut in such a way as to form a hole 4½ inches in diameter. In order to prevent the brass-wire gauze from becoming badly distorted by the action of the heat, it should be held in place by means of a second piece of galvanized iron (*i′*), which fits into the compartment and has a hole of the same diameter as the support (*i*).

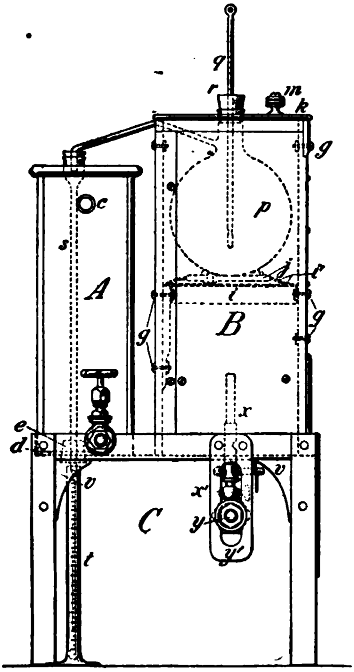

Fig. 5.—Plan of end of apparatus for moisture determination.

A, condenser; *B*, evaporating chamber; *C*, stand-supporting condenser and evaporating chamber, *c*, overflow pipe; *d*, washer soldered to bottom of condenser tank; *e*, rubber stopper supporting condenser tube; *g*, screw bolts; *i*, ledge for supporting gauze, triangle, and flask; *i′*, galvanized iron ring above gauze; *j*, flanged pipestem triangle; *k*, covers; *m*, handle on cover; *p*, distillation flask; *q*, thermometer; *r*, rubber stopper; *s*, condenser tube; *t*, graduated measuring cylinder; *v*, braces; *x*, burner; *x′*, extra stopcock beneath burner; *y*, gas pipe; *y′* support for gas pipe.

On the plate holding the gauze firmly in place (see fig. 4) rests a flanged pipestem triangle (*j*), which serves to raise the flask (*p*) about one-half inch above the brass-wire gauze, this being essential in order to prevent the corn which lies directly on the bottom of the flask from becoming too highly heated. If the flask rests on the gauze, the kernels in contact with the bottom of the flask directly over the flame will become carbonized and the percentage of water expelled will be too large. The interior arrangement of each compartment is more clearly shown in figure 9. The length of the flanged pipestem forming the sides of the triangle is 4 inches. The gauze is 30-mesh, made of No. 31 brass wire.

Each compartment is provided (see fig. 3) with an asbestos-lined cover (*k*) having a hole (*l*) in the center, thru which the neck of the flask (*p*) projects. The hole in the galvanized iron is made about one-fourth inch larger than the hole in the asbestos lining, the latter having

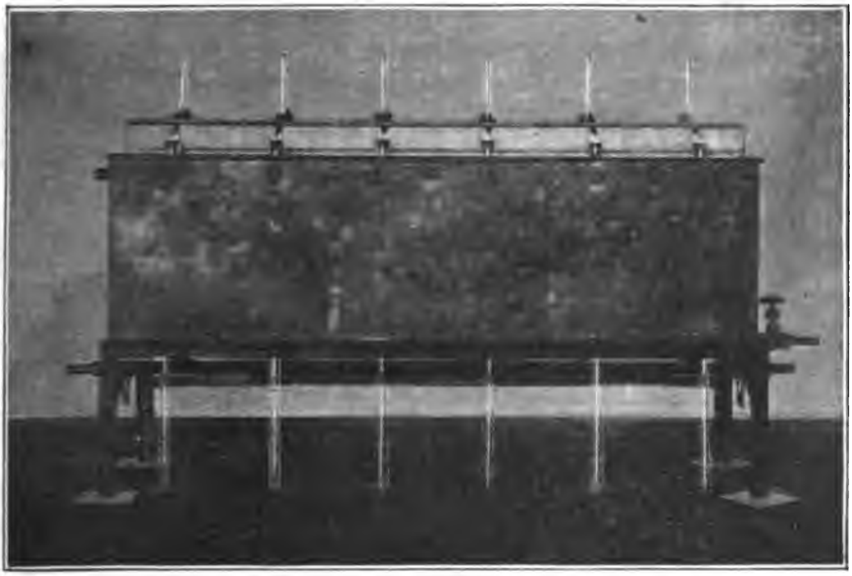

FIG. 6.—Front view of apparatus for moisture determination.

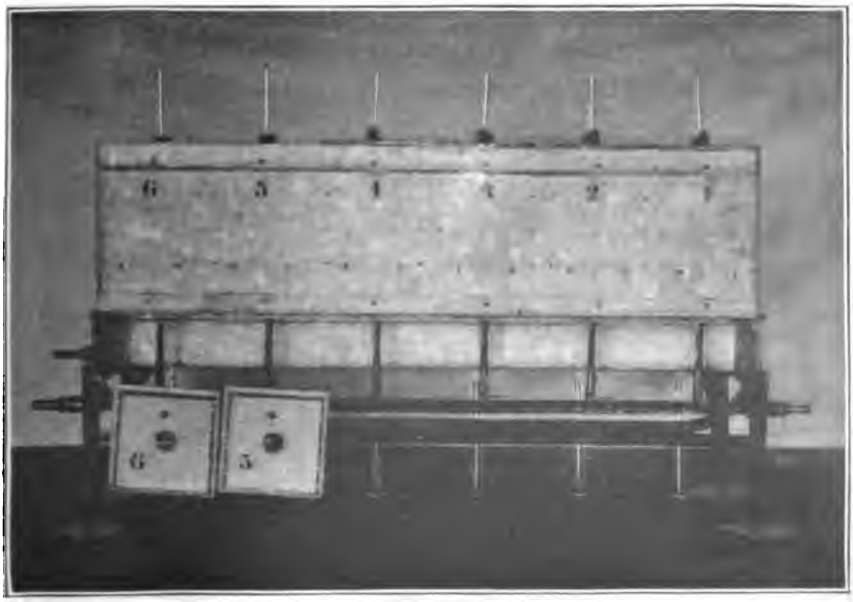

FIG. 7.—Back view of apparatus for moisture determination.

a diameter of 1¼ inches, thus forming a one-eighth inch asbestos projection (*l′*) to lessen the danger of breaking the necks of the flasks in placing or removing the covers. Each cover is provided with a wooden handle (*m*) and a five-eighths inch flange (*n*), the latter having a small notch at *o*, directly opposite the notch (*o′*) in the side of the chamber. The asbestos in the notch (*o′*) in the wall of the chamber should project sufficiently to form a cushion to protect the glass tube leading thru the notches *o*, *o′* to the condenser.

THE CONDENSER.

The condenser (figs. 3 and 5, *A*) consists of a plain copper tank 4 inches wide, 12 inches high, and of the same length as the evaporating chamber (*B*). In the bottom of the tank at points directly opposite the center of each of the compartments of the evaporating chamber are cut 1-inch holes for receiving the perforated rubber stoppers (*e*) thru which the ends of the glass condenser tubes (*s*) project into the measuring cylinders (*t*). Heavy one-eighth inch washers (*d*) are soldered around the holes in the bottom of the tank, so that the rubber stoppers (*e*) bearing the condenser tubes (*s*) can be prest in firmly, thereby avoiding the possible danger of any water leaking from the tank into the measuring cylinders. Thru the condenser tank passes a stream of cold water, entering thru the valve (*a*) and passing out at the overflow pipe (*c*). Connected with the valve (*a*) is a three-eighths inch pipe (*b*), which extends the full length of the tank. In this pipe, near each condenser tube, are two small holes (*b′*), drilled at such an angle that the cold water entering the tank will fall directly on the glass condenser tubes. In order to prevent the sides of the tank from bulging, extra braces (*f*) should be put in every 16 or 18 inches.

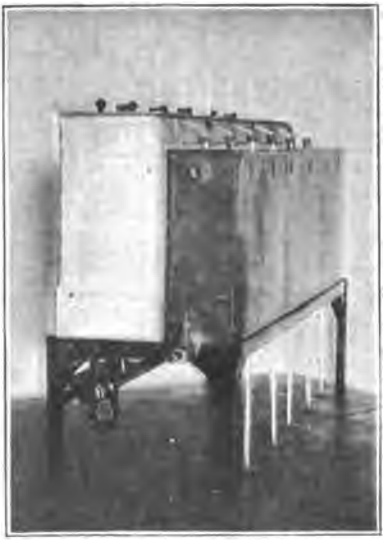

FIG. 8.—End view of apparatus for moisture determination.

THE STAND SUPPORTING THE EVAPORATING CHAMBER AND CONDENSER.

The stand (see figs. 3 and 5) supporting the condenser (*A*) and the evaporating chamber (*B*) is made of angle iron, with 1-inch sides and three thirty-seconds inch thick. The total height of the stand is 9¼ inches, which raises the bottom of the condenser tank 8⅜ inches above the work table, leaving ample room for the 8-inch measuring flasks (*t*) to be placed under the condenser tubes. The corners of the stand are strengthened by the braces (*v*). The cross piece (*w*) at the back of the stand is dropt 4 or 5 inches in order to facilitate the manipulation of the burners.

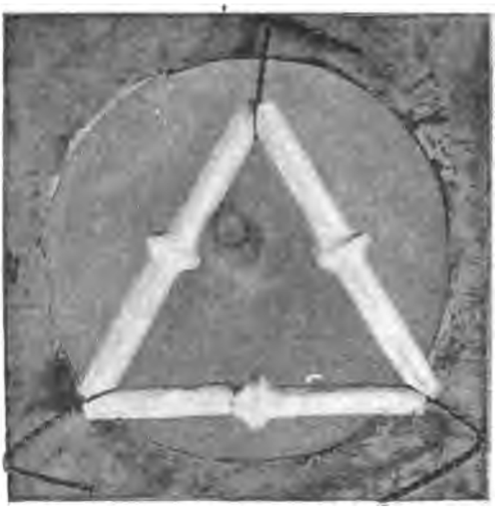
FIG. 9.—Interior arrangement of the compartments of the evaporating chamber, showing the position of the triangle over the gauze.

Between the burners (*x*) and the gas pipe (*y*) is inserted an extra stopcock (*x′*). With the extra stopcock directly beneath the burners the flow of gas can be regulated by setting either the valve in the burner (*x*) or the stopcock (*x′*), using the remaining one for turning on and off the gas. (Figs. 3 and 5.) The gas pipe (*y*) with the attached burners can be raised or lowered by loosening the nuts (*z*) at the slotted supports (*y′*) at either end of the stand.

THE DISTILLATION FLASKS.

The flasks (figs. 4 and 5, *p*) in which the mixture of corn and oil is heated are primarily distillation flasks having short necks and specially constructed side tubes. (Fig. 10.)

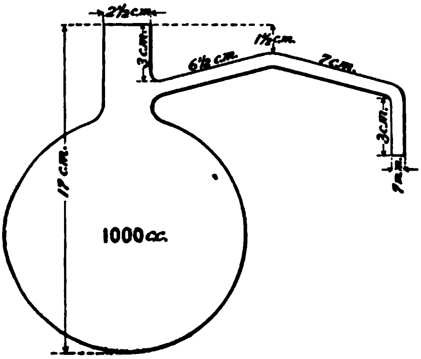

FIG. 10.—Distillation flask.

The flasks have a capacity of approximately 1,000 cubic centimeters. The necks of the flasks have a diameter of 2½ centimeters and are made without a flange and sufficiently heavy to stand tight corking. The side tube, which is 7 or 8 millimeters in internal diameter, is inserted approximately 3 centimeters from the top of the neck. The respective lengths of the three arms of the side tube are 6½, 7, and 3 centimeters. The bend between the two long arms is 1½ centimeters below a horizontal line drawn from the top of the neck of the flask. The total height of the flasks should be 17 or 17½ centimeters, or such that one-half centimeter or more of the neck will protrude thru the covers (*k*) of the evaporating chamber in order to protect the rubber stoppers (*r*) as much as possible from the action of the high temperatures.

THE THERMOMETERS.

While any standard chemical thermometer may be utilized, a thermometer graduated in degrees from 100° C. to 210° C. has been found most convenient. The 100-degree mark should come just at the top of the rubber stopper in the flask (17 centimeters from the bulb end of the thermometer), so that the rapidity of the rise in temperature can be watched if desirable after the water begins to pass over. The total length of such a thermometer need not be more than 27 or 28 centimeters. The bulb end of the thermometer should extend well into the mixture of corn and oil, approximately 1 centimeter from the bottom of the flask.

THE CONDENSER TUBES.

The construction of the condenser tubes (figs. 3 and 5), as represented at *s* in the detailed drawings, is shown in figure 11. The thimble at the top is 22 millimeters in diameter inside and 3 centimeters deep, giving ample space to make good connection with the distillation flasks by means of a rubber stopper on the end of the side tubes. The diameter of the remaining part of the tube is approximately 7 millimeters, the tube having a total length of 33 centimeters, so that the top of the tube will stand about one-half centimeter above the top of the water tank and the bottom of the tube project about 2 centimeters below the rubber stopper *e* at the bottom of the tank. The lower end of the tube should be cut at an angle, as shown in the illustration.

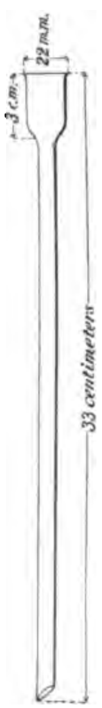

FIG. 11.—Condenser tube.

THE GRADUATED CYLINDERS FOR COLLECTING AND MEASURING THE WATER.

A convenient form of container for collecting and measuring the amount of water expelled from the grain is shown in figure 12. Each of the two cylinders here shown is 20 centimeters (approximately 8 inches) high and is graduated in fifths, the one with a reading capacity of 20 cubic centimeters and the other with a reading capacity of 25 cubic centimeters. For samples of very wet grain larger measuring cylinders will be necessary. With the graduations in fifths it is very easy to make the reading in tenths of a per cent, which is a sufficiently close percentage for all commercial grading of grain, as samples taken on different days will show a much wider variation. The graduations are in cubic centimeters, so that when 100 grams of grain are used for the test the percentage of water can be seen at once, 1 cubic centimeter of water representing 1 per cent. The cylinders should be of a uniform height, so that they can be used indiscriminately beneath any of the condenser tubes.

In expelling the water from the corn a small quantity of oil (less than one-half a cubic centimeter) is carried over into the graduated cylinders, which prevents them from drying rapidly after the readings have been made and the contents emptied at the close of the test. However, preparatory to their being used again the cylinders must be cleaned and dried, which can best be done with a test-tube cleaner having a small piece of sponge attached to the end.

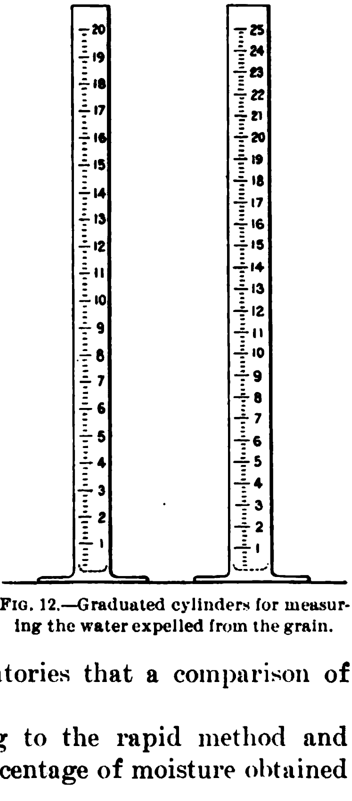

FIG. 12.—Graduated cylinders for measuring the water expelled from the grain.

COMPARISON OF RESULTS WITH DETERMINATIONS MADE IN A WATER OVEN.

The method and the apparatus for making moisture determinations of corn as described in the foregoing pages is so radically different from that commonly used in chemical laboratories that a comparison of results seems advisable.

Duplicate tests were made according to the rapid method and likewise in a water oven, the average percentage of moisture obtained in each case being shown in Table I.

Table I.—*Moisture in corn samples as determined by quick method and in water oven.*

Sample No.—	Moisture determined by quick method.	Moisture determined in water oven.	Sample No.—	Moisture determined by quick method.	Moisture determined in water oven.
	Per cent.	*Per cent.*		*Per cent.*	*Per cent.*
1	13.10	12.93	15	13.30	12.93
2	13.20	12.88	16	12.80	12.84
3	26.15	26.01	17	20.40	20.24
4	14.05	13.75	18	24.85	24.58
5	13.43	13.44	19	26.90	26.90
6	27.05	26.78	20	21.55	20.98
7	22.25	22.00	21	20.44	20.32
8	20.40	20.57	22	19.00	19.08
9	13.45	13.42	23	17.76	17.74
10	18.15	17.94	24	12.05	12.10
11	12.43	12.39	25	20.35	20.31
12	20.44	20.21	26	13.48	13.23
13	13.55	13.42	27	11.60	11.54
14	11.90	11.86	28	13.14	13.01

From the 28 samples represented in the foregoing table the average moisture obtained, according to the quick method, was 17.40 per cent and the average of the determinations made in a water oven was 17.26 per cent, a difference of 0.14 per cent. This difference is favorable to the quick method, for the percentage of moisture obtained by drying starchy grains in a water oven is slightly below the actual amount of free water in the grain.

In the majority of cases the whole kernels were likewise used for making the moisture tests in the water oven, the drying being continued from ninety-six to one hundred and twenty hours, and in the case of exceptionally hard kernels the drying was prolonged to one hundred and thirty-six hours or more.

The whole kernels were used in order to obviate the loss of water due to grinding, which in case of samples having a high percentage of moisture is considerable. One sample gave 26.01 per cent from the whole kernels and 24.36 per cent from the ground sample; another, 35.68 per cent from the whole kernels and 34.75 from the ground sample. The average of 16 samples gave 20.13 per cent for the whole kernels and 20.05 per cent for the ground sample, the moisture content of the different samples varying from 12.71 per cent to 35.68 per cent.

VARIATIONS IN DUPLICATE TESTS.

The amount of variation in different tests made at the same time from the same lot of corn will depend largely on the uniformity of the samples and on the care of the operator.

If the corn being analyzed is of inferior quality, containing a number of rotten kernels, or is a mixture of wet and dry corn, it is almost impossible to get samples of 100 grams each which will give the same results, and in such cases a variation of one-half of 1 per cent or more is to be expected, whatever method is used for determining the percentage of moisture. But if the corn being examined is of uniform quality and the moisture determinations are carefully made, the variation in the results of duplicate tests will usually not exceed one-fifth of 1 per cent, while many samples will give a much smaller variation. However, a variation of even one-half of 1 per cent is sufficiently close for all commercial work, inasmuch as two samples taken on different days or from different parts of the same car or cargo will generally show a much greater variation than this.

Table II shows the results of the determinations of 15 samples of corn. representing almost all grades from new corn to wet and larvæ-eaten samples, in which the average variation is 0.22 per cent.

TABLE II.—*Variations in the percentage of moisture obtained from different tests made from the same lot of corn.*

Sample No.—	Moisture.						Average.	Variation.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1	11.95	11.8	12.1	11.8	11.8	11.95	11.9	0.3
2	13.15	13.1	13.2	13.1	13	13.3	13.14	.3
3	11.4	11.75	11.7	11.4	11.75	11.7	11.6	.35
4	13.2	13.1	13	13.1	13	13.4	13.16	.4
5	17.7	17.6	17.7	17.5	17.9		17.68	.3
6	13.8	13.4	13.9	13.7			13.7	.5
7	20.4	20.3	20.7	20.3			20.4	.4
8	11.3	11.3	11.3				11.3	.0
9	20.7	20.9					20.8	.1
10	26.2	26.1					26.15	.1
11	13.2	13.2					13.2	.0
12	27	27.1					27.05	.1
13	24.8	24.9					24.85	.1
14	34.8	35					34.9	.2
15	35.9	36.05					35.98	.15

SUMMARY.

(1) The principal cause of the deterioration of corn in storage or during transit is an excessive amount of moisture.

(2) With the method and apparatus herein described for making moisture determinations, a percentage system of grading corn is well within the possibilities of the trade.

(3) The method described consists primarily in heating a definite quantity of corn in an oil bath to drive off the water, which is condensed and measured in a graduated cylinder.

(4) The time required for making the moisture determination will be from twenty to twenty-five minutes.

(5) With the proposed quick method for making moisture determinations one man familiar with laboratory work, with an assistant, should be able to test 200 samples in a day of eight hours.

(6) The apparatus consists primarily of (*a*) an evaporating chamber divided into two or more compartments, (*b*) a copper tank forming the condenser, and (*c*) a stand to support the evaporating chamber, the condenser, and the burners.

(7) The apparatus described shows six compartments, but it can be made in any size desired.

(8) The whole kernels are used for the test, no time being consumed by grinding; moreover, damp or wet grain can not be ground without a considerable loss of moisture.

(9) Only one weighing is required, for which an ordinary torsion balance is used, a delicate analytical balance being entirely unnecescessary.

(10) One hundred grams of corn are used for the test; consequently, each cubic centimeter of water in the graduated cylinder represents 1 per cent of moisture.

(11) When the thermometer in the distillation flask registers 190° C. (374° F.) the gas should be turned off, after which eight or ten minutes must elapse before the reading of the amount of water expelled is made.

(12) The distillation flask is closed and connected with the condenser tube by means of rubber stoppers of a grade that will not be readily affected by high temperatures.

(13) The oil used is a good grade of pure hydrocarbon oil having a flash point (in open cup) of from 200° C. to 205° C. Such oils are sold in the market as "engine oils" and can be purchased in barrel lots for 12½ or 15 cents a gallon.

(14) The oil should be poured into the flask first to lessen the danger of its being broken by the kernels of corn dropping on the bottom.

(15) The bulk samples from which the 100-gram samples are taken for the moisture test must be kept in air-tight containers if accurate results are expected.

(16) The bulk samples should be taken in such a was as to represent the quality of the entire lot of grain under consideration.

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THE PHILADELPHIA MUSEUMS
FEB 25 1907

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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 100.

B. T. GALLOWAY, *Chief of Bureau.*

PHILADELPHIA MUSEUMS JUN 10 1907

MISCELLANEOUS PAPERS.

I. CRANBERRY SPRAYING EXPERIMENTS IN 1905.
By C. L. SHEAR, *Pathologist.*

II. THE WRAPPING OF APPLE GRAFTS AND ITS RELATION TO THE CROWN-GALL DISEASE.
By HERMANN VON SCHRENK, *Special Agent,*
and GEORGE G. HEDGCOCK, *Assistant.*

III. GARLICKY WHEAT.
By J. W. T. DUVEL, *Assistant.*

IV. METHODS OF TESTING THE BURNING QUALITY OF CIGAR TOBACCO.
By WIGHTMAN W. GARNER, *Scientific Assistant.*

V. THE DRUG KNOWN AS PINKROOT.
By W. W. STOCKBERGER, *Expert.*

VI. ORCHARD GRASS.
By R. A. OAKLEY, *Assistant Agriculturist.*

VII. THE EFFECT OF COPPER UPON WATER BACTERIA.
By KARL F. KELLERMAN, *Physiologist,*
and T. D. BECKWITH, *Scientific Assistant.*

VIII. CONDITIONS AFFECTING LEGUME INOCULATION.
By KARL F. KELLERMAN, *Physiologist,*
and T. R. ROBINSON, *Assistant Physiologist.*

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CONTENTS.[a]

Page.

Cranberry spraying experiments in 1905 7
  Introduction 7
  Spraying and its results 8
  Importance of early applications 9
  Effects of spraying plants when in full bloom 10
  Keeping qualities of sprayed and unsprayed fruit 10
  Cost and recommendations 11
The wrapping of apple grafts and its relation to the crown-gall disease 13
  Introduction 13
  Account of experiments 14
  Manner of wrapping 15
  Grafts left unwrapped 16
  Results of wrapping 16
    Effect upon the union 16
    Effect on crown-gall formation 18
  Recommendations 18
  Suggestion to nurserymen 19
  Summary 20
Garlicky wheat 21
  Introduction 21
  Wheat containing garlic 21
  Experiments in separating garlic from wheat 22
    Lot A 23
    Lot B 24
    Lot C 25
  The total cost of drying and cleaning garlicky wheat 26
    The net cost of removing garlic 28
  The effect of the drying on the milling qualities of the grain 28
  The effect of the drying on the vitality of the wheat 29
  Machinery used for drying and cleaning 30
  Summary 30
Methods of testing the burning quality of cigar tobacco 31
  Introduction 31
  The smoking test 33
  The effects of the filler, the binder, and the wrapper on the burn of the cigar. 35
  Testing the capacity for holding fire and the evenness of the burn 37
  Testing the burn of cigar-filler tobacco 40
The drug known as pinkroot 41
  Introduction 41
  Trade varieties of pinkroot 41
  Identity of chief substitutes 42

---

[a] The eight papers constituting this bulletin were issued in separate form on February 7, February 28, April 5, June 9, October 9, October 8, October 20, and November 30, 1906, respectively.

The drug known as pinkroot—Continued. Page.
- Minor adulterants 43
- Methods of distinguishing pinkroot from its substitutes 43

Orchard grass 45
- Introduction 45
- Methods of culture 46
  - Seeding 46
  - Mixtures with red clover 47
  - Mixtures with other grasses 48
  - Life of meadows 49
- Uses and value 49
  - Hay 49
  - Pasture 50
  - Seed 50
    - Harvesting the seed crop 51
    - Thrashing 51
    - Handling the aftergrowth 52
    - Value of the straw 52
    - Weeds in orchard grass seed fields 53
    - Other grasses in fields intended for seed 54
- Summary 55

The effect of copper upon water bacteria 57
- Introduction 57
- Resistance of various bacteria 59
- Effect of carbon dioxid on viability of Bacillus coli and Bacillus typhi 64
- Copper sulfate and filtration 69

Conditions affecting legume inoculation 73
- Introduction 73
- Use of lime 74
- Effect of soil conditions upon bacteria 76
- Effect of heavy inoculation 79
- Effect of aeration 81
- Associative action of bacteria 82
- Summary 83

ILLUSTRATIONS.

PLATES.

Page.
PLATE I. Wheat kernels and the aerial bulblets of wild garlic. Natural size.. 22
II. Fig. 1.—*A*, 1-pound sample of garlicky wheat, Lot A, as received; *B*, amount of garlic in 1-pound sample when received, 2.17 per cent; *C*, amount of garlic remaining in 1-pound sample after drying and cleaning, 0.05 per cent. Fig. 2.—*A*, 1-pound sample of garlicky wheat, Lot B, as received; *B*, amount of garlic in 1-pound sample when received, 0.56 per cent; *C*, amount of garlic in 1-pound sample after drying and cleaning, 0.06 per cent. Fig. 3.—*A*, 1-pound sample of garlicky wheat, Lot C, as received; *B*, amount of garlic in 1-pound sample when received, 2.04 per cent; *C*, amount of garlic remaining in 1-pound sample after drying and cleaning, 0.16 per cent 24
III. Variation in burn of wrappers due to different fillers 34
IV. Variation in burn of fillers due to different wrappers and binders... 36
V. Pinkroot (*Spigelia marilandica* L.) 42
VI. East Tennessee pinkroot (*Ruellia ciliosa* Pursh) 44
VII. Fig. 1.—Harvesting orchard grass for seed. Fig. 2.—Method of shocking orchard grass; shocks showing bands at top 50
VIII. Pots of red clover, showing the effect of lime on a soil unfavorable to the growth of clover 76
IX. Fig. 1.—Pots of garden peas, showing the effect of aeration on growth. Fig. 2.—The garden peas illustrated in figure 1, showing the effect of aeration on nodule formation 80

TEXT FIGURES.

FIG. 1. The apparatus used in the cranberry spraying experiments 8
2. Apparatus for testing the burning quality of cigars 34
3. Apparatus for testing the burning quality of wrapper tobacco 38
4. Construction of form on which leaf is wrapped for use in apparatus shown in figure 3 38
5. Cross section of the root of *Spigelia marilandica* L 44
6. Cross section of the root of *Ruellia ciliosa* Pursh 44

THE PHILADELPHIA
JUN 10 1907
MUSEUMS

B. P. I.—200. V. P. P. I.—150.

MISCELLANEOUS PAPERS.

I.—CRANBERRY SPRAYING EXPERIMENTS IN 1905.

By C. L. Shear, *Pathologist*.

INTRODUCTION.

In Farmers' Bulletin No. 221[a] a brief account was given of cranberry diseases, and also the results of spraying experiments with Bordeaux mixture. The results in 1904 were not entirely satisfactory. This was not due, however, to the inefficiency of Bordeaux mixture, but to circumstances which prevented the applications being made at proper intervals. The results obtained in 1904 showed an average of 21.7 per cent of rotten berries on the sprayed plats, as compared with an average of 76.8 per cent rotten on the unsprayed check plats. Considering the unsatisfactory manner in which the Bordeaux mixture was applied, the prediction was ventured that it would be possible with more thorough treatment to reduce the loss from rot to 10 or 15 per cent. The results obtained in 1905 have more than justified this prediction.

The experiments were conducted on what is known as the Bunker Hill bog at Whitesville, N. J., which is in charge of Mr. James D. Holman, the same plats being used as in 1904, with the addition of a small area not heretofore sprayed. This bog was selected because the fruit had in former years been almost entirely destroyed by disease. The water was drained from the bog May 10–12. It is the usual practice of cranberry growers to flood bogs for twenty-four hours during the first week in June, in order to destroy insects. In these experiments it was planned to spray part of the experimental plats before this second flooding and part immediately afterwards, in order to determine the necessity or desirability of spraying before this flooding. The water supply of the bog was, however, insufficient to flood it at the usual time, and it was not done.

The spraying apparatus used was a barrel and force pump fitted with two lengths of half-inch hose, each length provided with an extension rod and two Vermorel nozzles. The apparatus was driven about the bog in a low-bodied spring wagon, as shown in figure 1.

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[a] Farmers' Bulletin No. 221, U. S. Dept. of Agriculture, "Fungous Diseases of the Cranberry."

The Bordeaux mixture used consisted of 6 pounds of copper sulphate (bluestone) and 6 pounds of fresh stone lime to 50 gallons of water, to which was also added 4½ pounds of commercial resin-fishoil soap. The addition of this soap has been found to be indispensable, as Bordeaux mixture will not spread over and adhere satisfactorily to the glossy surface of the cranberry leaves and fruit without it. Heretofore this soap has been made as it was needed for use. Its manufacture was not an altogether pleasant operation. Now that the soap is being manufactured and placed on the market at about 3 cents per pound, it is cheaper and much more convenient to purchase it than to make it.

SPRAYING AND ITS RESULTS.

The sprayed plats were numbered 3, 5, 6, 7, and 9, the plats between being left as checks. Plats 3 and 7 were sprayed five times, as follows: May 19, June 22–23, July 14–17, July 31–August 1, and August 15–17. On September 8, accurate counts were made of all the diseased and sound berries on small areas, showing the average condition of the berries on the sprayed plats; also of equal areas, showing the average condition of the berries on the check plats. Plat 3 gave 3.23 per cent of rotten berries, plat 7 gave 8.8 per cent of rotten fruit, check plat 2 showed 91 per cent of rotten fruit, and check plat 8 gave 91.53 per cent of rotten berries, giving an average of a fraction over 6 per cent of rotten fruit for the sprayed plats and a little more than 91 per cent for the unsprayed plats. On these two plats it will be noted that the first application was made on May 19, when the vines had but just com-

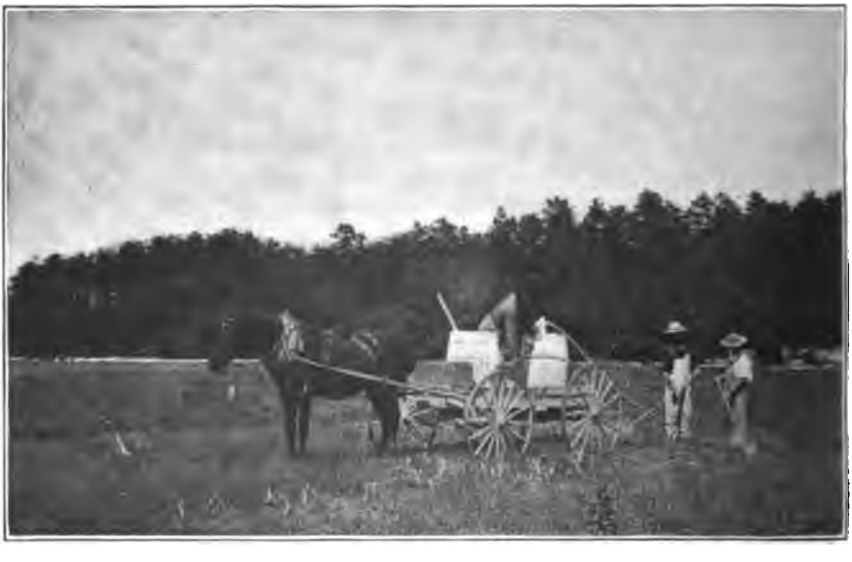

FIG. 1.—The apparatus used in the cranberry spraying experiments.

menced to put out new growth. This application was the one mentioned as being made before the usual flooding for insects.

Plats 5 and 9 were sprayed five times, as follows: June 2, June 22–23, July 14–17, July 31–August 1, and August 15–17. On June 2, when the first application was made to these plats, there was a good growth of young shoots and leaves. Counts of fruit on small areas, as in the preceding case, gave the following results: Sprayed plat 5, 2.62 per cent of rotten berries; sprayed plat 9, 2.1 per cent of rotten fruit; check plat 4, 91.8 per cent rotten; check plat 10, 93.5 per cent rotten, giving an average of 2.36 per cent of rotten berries on the sprayed plats and 92.6 per cent of rotten fruit on the unsprayed plats. There was very little difference in the amount of rot on this series of plats and that on the series mentioned in the preceding paragraph.

Plat 6 was sprayed but three times, as follows: July 14–17, July 31–August 1, and August 15–17. Counts made, as in the previous cases, on September 8, gave the following results: Sprayed plat, 18.3 per cent of rotten berries; check plat, 91.53 per cent of rotten fruit. It may also be added that a greater number of the berries from this sprayed plat decayed before they were ready for shipment than was the case with the fruit from the plats which received five applications.

The fruit from an area of 1,048 square feet, showing average condition of fruit on sprayed plat 7, was carefully hand picked and produced 3 bushels of sound fruit, which is at the rate of about 125 bushels per acre. The same area from check plat 8, showing the average condition of fruit, gave a scanty peck, or at the rate of about 10$\frac{5}{12}$ bushels per acre. In other words, there was twelve times as much sound fruit on the sprayed as on the unsprayed plat, or a saving of over 100 bushels per acre.

Besides our purely experimental plats, several acres upon another cranberry bog known as "Long Swamp" were sprayed by Mr. Holman. One portion was sprayed five times on the following dates: June 6–10, June 26–28, July 18–21, August 2–4, and August 18–19. One part was sprayed only four times. The first plat, which was also sprayed in 1904, was estimated to have from 80 to 100 per cent of the fruit sound on September 15. On the area sprayed only in 1905 it was estimated that from 70 to 90 per cent of the fruit was sound. On the plat which received the first four applications only, the fruit showed somewhat more rot than on the other plats at picking time. The fruit on these plats had in former years been almost entirely destroyed by rot.

IMPORTANCE OF EARLY APPLICATIONS.

The difference in the appearance of the fruit on the sprayed and unsprayed plats was very marked by the middle of July. On the unsprayed plats a large proportion of the fruit was blasted, owing to the early attack of the scald fungus (Guignardia), while on the sprayed plats but little blasted fruit was to be seen. In many cases at least one-half of the fruit is destroyed by blasting, the young fruits being attacked by the fungus at about the time the blossoms begin to fall. In order to prevent this, one of the applications of Bordeaux mixture should be made immediately after the vines have reached their maximum flowering stage, as a delay of a week at this time may make a difference of from 25 to 50 per cent in the amount of fruit destroyed by blasting.

A very striking illustration of this fact was observed upon another bog where one plat had been sprayed on July 1 and another adjoining was not sprayed until July 8. On the plat sprayed on July 1, when the vines had just reached their maximum flowering condition, but very little blasted fruit could be found, whereas on the plat which had been sprayed on July 8 about one-half of the fruit had been blasted. This and other observations indicate the exceedingly great importance of prompt and thorough early applications of the fungicide. In case the bog to be sprayed is flooded for insects early in June, the first application of Bordeaux mixture should be made within a day or two after the water is removed, the second application just as the plants begin flowering, and the third just after the majority of the blossoms have appeared, which in ordinary seasons will be about the first of July.

EFFECT OF SPRAYING PLANTS WHEN IN FULL BLOOM.

In order to determine whether any injury would result from spraying the plants while in bloom, part of one plat was sprayed when in full bloom, and the amount of fruit which set upon this plat was carefully compared with that on adjoining plats which had not been sprayed. No difference could be noted in the amount of fruit on the sprayed and on the unsprayed plats. In addition, certain bunches of vines were dipped in Bordeaux mixture when in full bloom, but without any apparent injury to the fruit. From our observations and experiments it does not appear that there is much danger of loss from spraying vines while in bloom. What little loss might possibly arise from this cause would be very slight compared with the amount of loss from blasted fruit in case the spraying was delayed too long.

KEEPING QUALITIES OF SPRAYED AND UNSPRAYED FRUIT.

A comparison of the sprayed and unsprayed fruit at the time of picking does not give an exact idea of the amount of profit derived from the treatment, as there was a much greater loss of unsprayed than of sprayed fruit between the time of picking and the time the berries were marketed.

In order to compare the keeping qualities of the sprayed and unsprayed fruit, as well as unsprayed fruit which had been treated with a solution of copper sulphate (1 part to 1,000 of water), 3,600 berries, perfectly sound so far as could be seen from external appearance, were selected from fruit picked on September 18, 1905. Of these, 1,200 were from the sprayed plats and the remainder from the unsprayed check plats. These berries were kept in glass dishes in the laboratory and counted each week, in order to determine the amount of disease which developed. On October 18, about the time the fruit from the bog was marketed, 9.8 per cent of the sprayed fruit showed diseased berries, while 38.1 per cent of the unsprayed fruit and 37.4 per cent of the unsprayed fruit which had been treated with the copper-sulphate solution were diseased. In other words, four times as much of the unsprayed fruit decayed between the time of picking and marketing as of the sprayed fruit.

Parts of the check plats which were worth picking were picked by hand and the fruit kept separate. This fruit was sorted for shipment on October 15, 1905, when from 85 to 90 per cent of it was rotten. Mr. Holman states that 40 per cent of all the unsprayed berries from Bunker Hill bog decayed between the time of picking and marketing. No treatment of the berries with fungicides after picking is likely to give satisfactory results, as we have found that the decay which occurs in storage does not arise from germs which are on the surface of the fruit at the time it is picked, but apparently from a dormant form of the fungus already within the berries, where it is awaiting favorable conditions for development.

As the time for picking approached, so much of the Bordeaux mixture adhered to the sprayed fruit that it was feared enough might be present when the berries were marketed to interfere with their sale. This, however, did not prove to be the case, as the greater portion of the mixture was removed from the fruit during the processes of picking, sorting, and preparing the fruit for market.

As the result of three years' spraying experiments, it is safe to say that by the proper use of Bordeaux mixture the loss from fungous diseases can be reduced to 10 per cent or less. The loss may be slightly more the first year a badly diseased bog is treated, as the benefit, as shown in these experiments, is greater the second year than the first, and is evident not only in the prevention of scald and rot of the fruit, but in the general improvement, thriftiness, and productiveness of the vines. Bordeaux mixture has also been applied with very beneficial results to young vines not yet in bearing, the leaves of which were badly affected by the scald fungus.

COST AND RECOMMENDATIONS.

The cost of the spraying as it was done in these experiments averaged from $15 to $20 an acre, the mixture being applied at the rate of four barrels, or 200 gallons, an acre at each application, making for the five applications a total of 1,000 gallons to the acre.

In undertaking the application of Bordeaux mixture it is necessary that all material and apparatus be in perfect readiness before the time to begin the work, and nothing should be allowed to interfere with the application of the fungicide at proper intervals; otherwise, the results will be unsatisfactory, and the remedy is likely to be unjustly condemned.

The necessity for care and thoroughness in the preparation and application of the mixture must also be strongly emphasized. The mixture should be made as described in Farmers' Bulletin No. 221, using only good, fresh stone lime and adding resin-fishoil soap. A good nozzle (the Vermorel type is best) should be used and the vines very thoroughly covered at each spraying. Four barrels of the mixture to the acre are ordinarily sufficient, but where the vines are very dense and heavy five barrels may be necessary. Where there is an excessive growth of vines, it will be found advantageous to rake them with a knife rake and thin them out, as is frequently done in order to prepare a bog for picking with scoops.

B. P. I.—208.

II.—THE WRAPPING OF APPLE GRAFTS AND ITS RELATION TO THE CROWN-GALL DISEASE.

By HERMANN VON SCHRENK, *Special Agent in Charge of the Mississippi Valley Laboratory*, and GEORGE G. HEDGCOCK, *Assistant in Pathology*.

INTRODUCTION.

The crown-gall disease of apple trees, as indicated in a recent publication of the Bureau of Plant Industry,[a] appears in three distinct types—the hard crown-gall, the soft crown-gall, and the hairy-root forms. While the hairy-root disease of apples has usually been considered a type of the crown-gall disease, it in reality is an entirely different trouble, with manifestations which are not in the least like those met with in the true crown-gall disease. The soft type of crown-gall on the apple has not yet been clearly differentiated from the hard type, and in the following discussion the two are considered as one.

The knots which characterize the crown-gall disease of the apple usually appear at some point, either on the root piece or on the scion, where the two are united; that is, the gall may form at the end of the tongue of either the scion or root piece, or at any point where either piece has been wounded. This fact is one commonly recognized by all nurserymen and scientific workers who have studied this disease. About 90 per cent of these knots will appear on the end of the scion piece. The exact cause of the formation of the gall is as yet somewhat uncertain. It would seem, however, that, whatever the cause, the point most exposed to the disturbing factor, whether it be due to a fungus, to bacteria, or to soil or atmospheric conditions, is the junction of the scion and root piece.

When the newly made grafts are laid away in the grafting cellar either in sawdust, excelsior, moss, or other bedding material, callous tissue begins to form on the cut surfaces of both scion and root piece. This callous tissue from the two pieces will in time fill the intervening spaces between the surfaces of the scion and the root piece, and ultimately the root callus and the scion callus will join. Where the root piece and the scion are of exactly the same size and where they are united so as to fit exactly, a very perfect union will take place. Where there is a difference in size between the root piece and the scion, or where they are more or less imperfectly fitted, as is almost always the case in commercial grafts, the callus formed by the scion and the root piece will not always meet along equal planes. In these cases there will be a tendency for the callus forming on any surface of either piece which is not in direct contact with an opposite surface (no matter how small this surface may be) to grow out from this surface, either laterally or down or up, into the air, with nothing to prevent its growing into small lumps, which may reach considerable size. Very frequently the pressure exerted by the growing callus will push the tongue of the graft outward. A thick cushion of callus will then form between the scion and root piece.

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[a] Bulletin No. 90, Part II, Bureau of Plant Industry, U. S. Dept. of Agriculture, "The Crown-Gall and Hairy-Root Diseases of the Apple Tree," 1905.

The object of all grafting should be to bring about as rapid a union between the two grafted parts as possible, with the smallest possible period during which an open wound is allowed to remain into which disturbing factors may enter. With this in mind, a number of experiments were made during the past year, the specific objects of which were to confine the formation of callus as far as possible to the spaces between the root and scion pieces, thereby bringing about a closer and more effective union and reducing the chances for the entrance of possible disturbing factors.

It is intimated that the formation of the hard and soft types of apple crown-gall may be due either to a proliferation of callous tissue in cases where an uneven union is taking place and where the callus has had a chance to grow out laterally in an unrestricted manner, or to fungi, bacteria, or unfavorable soil or atmospheric conditions. Whatever the cause, the making of a perfect union in the shortest possible time may serve to prevent the trouble almost wholly if the first explanation given be the cause, and at least largely remove the danger of a possible infection if the second explanation is found to hold good.

ACCOUNT OF EXPERIMENTS.

In order to confine the formation of the callus, a number of grafts were wrapped with various materials during the winter of 1904–5. The wrapping idea is no new one, because cloth and paper were used by nurserymen many years ago in connection with various types of root and top grafting. At the present time cloth and paper are used very little, because the system of thread wrapping will give a larger number of grafts in a given period of time. The materials used in our experiments were cloth, thin sheet rubber (dental rubber), and waxed paper. In addition to this, grafts were made with plain thread and waxed thread, and some grafts were wrapped with plain thread and afterwards the whole union was covered with grafting wax. One series of grafts was made without any wrapping of cloth or thread whatever, the pieces being simply fitted together with care. All grafts made were of the type known as tongue or whip grafts. The work was done by an expert, so that all of the grafts may be considered as especially well made. No. 1 Kansas roots and a selected lot of scions of the following varieties were used: Winesap, York Imperial, Wealthy, Missouri, and Northern Spy. The grafts were made in February, 1905. They were stored in chopped excelsior for about six weeks, were then planted in eight different localities in Missouri, Illinois, Iowa, Nebraska, Kansas, and Arkansas, and given the usual cultivation during the summer. All showed a fair stand in November, 1905. Some of the grafts were dug in November, and December, 1905, one-third of the total number planted in five test plats in four States being dug. The results obtained are given later.

MANNER OF WRAPPING.

The manner in which the wrapping was made and the material used may be briefly described as follows:

Cloth.—The cloth used was a cheap black calico of the poorest grade obtainable in the market. This was torn into strips 1 inch wide and 4 or 5 inches long. After the graft was made, one end of the cloth was dipped for one-half inch into hot melted grafting wax. Starting with the other end, the cloth was then wrapped tightly around the scion and the free waxed end pressed down. This completed the operation.

Rubber.—The rubber used was of a quality similar to dental rubber, which is also frequently used for insulating wires. It was bought in rolls 1 inch wide, and was cut off in such lengths as were necessary to completely envelop the union. The rubber was usually wrapped so as to go around the union twice, and the free end was fastened with rubber cement applied with a brush.

Waxed paper.—Sheets of ordinary unglazed printers' paper were waxed on one side by coating them with hot grafting wax applied with a paint brush. They were then cut into inch strips, 10 to 20 sheets being cut at one time, and these again into strips about 4 or 5 inches long. One paper strip was then wrapped around the union, the waxed side toward the graft, the free end being stuck down by pressing it on.

Plain thread.—The thread used for the ordinary grafts was a machine cotton, No. 9.

Waxed thread.—The thread used was a machine cotton, No. 28. This thread was soaked in hot grafting wax until thoroughly penetrated and was then allowed to drain while hot.

Plain thread with union waxed.—These were ordinary grafts made with plain thread, wrapped as previously described, and then coated with melted grafting wax nearly at the point of hardening.

GRAFTS LEFT UNWRAPPED.

The grafts left without wrapping of any kind were made with special care, so that when the roots and scions were joined they remained firmly united.

RESULTS OF WRAPPING.

After digging the grafts, a careful examination of the various series was made to determine the effect of the wrapping on the union and on the presence or absence of crown-gall formation.

The following table shows the number of apple trees dug, the character of the wrapping, and the number and percentage of smooth trees and rough trees, the latter class including all trees which were found to have crown-gall, irregular callus, or hairy-root formations:

TABLE 1.—*Comparison of smooth trees and rough trees resulting when different methods of grafting were used.*

Kind of wrapping.	Total number.	Smooth trees.		Rough trees.	
		Number.	Per cent.	Number.	Per cent.
Rubber	675	584	86.5	91	13.5
Cloth	709	604	85.1	105	14.9
Waxed paper	671	474	70.6	197	29.4
Plain thread	645	442	68.5	203	31.5
Waxed thread	675	430	63.7	245	36.3
Plain thread with union waxed	402	178	44.2	224	55.8
Unwrapped	569	312	54.8	257	45.2

Two series of facts may be deduced from this table—

(1) The effect of the various kinds of wrapping on the smoothness of the union.

(2) The effect of wrapping on the presence or absence of crown-gall formations.

EFFECT UPON THE UNION.

Some brief notes on the effect of the wrapping on the union follow. By a smooth graft is meant one which shows no uneven or irregular masses of callus. In the smooth grafts all parts are firmly united, so that no ridge or roughness is felt when the union is rubbed with the fingers. The grafts were graded with the greatest care.

Cloth.—When the grafts were planted in the spring the cloth was usually intact. When dug in the autumn it had almost entirely rotted away on all grafts. The union which resulted under the cloth was generally smooth and very even. In many cases it was difficult to detect the original position of the scion and root parts. The cloth had evidently remained in position long enough to thoroughly confine the callus to the spaces between the wounded surfaces.

Rubber.—When the grafts were planted the rubber wrapping was wholly intact. When dug the rubber was still found around the union in the majority of cases. It had, however, exerted no injurious effect, because, as the young trees had grown in diameter, the rubber had expanded. The roots had frequently punctured the rubber freely. In other words, the rubber had in no way retarded the growth. The unions formed under the rubber were smooth and even; in fact, they were the most perfect of all those formed in the experiment. The rubber covering was practically waterproof. So perfect were the unions that in many cases it was possible to detect the line of demarcation between the root and scion only by the difference in color.

Waxed paper.—When planted in the spring the waxed paper had not rotted, but it had a tendency to become unrolled, due probably to too much oil in the wax. When dug in the autumn the paper had mostly disappeared. The grafts showed many smooth trees, but the percentage was not nearly so large as in the case of those wrapped with rubber or cloth. Attention should be called to the fact that in all grafts where wax was used the wax itself seemed to exert an unfavorable effect on the union, and the writers are inclined to discourage its use wherever it comes into direct contact with wounded surfaces.

Plain thread.—When planted in the spring the plain thread had in many instances entirely rotted away. The grafts when dug showed many callus proliferations. The percentage of smooth grafts was low when compared with rubber or cloth wrappings. The results were about as good as those secured by the use of waxed paper wrapping, and a little better than those obtained with waxed thread.

Waxed thread.—When the grafts were planted the waxed thread was intact. When dug in the autumn the grafts showed from 6 to 8 per cent with knots caused by the pressure exerted by the thread, which had not rotted away because the wax protected it more or less. The percentage of smooth trees aside from this was almost the same as for the plain thread. No perceptible advantage appeared to be gained by the use of waxed thread as compared with plain thread.

Plain thread with union waxed.— At the time of planting it was noted that the wax had in many instances penetrated between the surface of the two pieces. The callus had formed in irregular masses, there being nothing to confine it. It furthermore appeared as if the wax had exerted the unfavorable effect already referred to in connection with the use of waxed paper. When dug the trees in the majority of instances showed thread knots, due no doubt to the fact that the wax had retarded the rotting away of the thread. The unions were usually rough. The unfavorable effect ascribed to the wax was evident not only in the immediate wound areas, but also all along the bark on both scion and root pieces, wherever the wax came in contact with the tissue.

Unwrapped grafts.—The grafts with no wrapping showed the excessive development of callus more than any others. However, many of the resulting trees when dug in the autumn showed fairly good unions. The grafts as a whole fell below the wrapped ones in the number of smooth trees. There were more deficient trees in this lot, with the possible exception of those waxed over, owing to defective unions and failures to form a union.

EFFECT ON CROWN-GALL FORMATION.

As indicated in the introduction, one of the objects of the experiment was to determine whether by wrapping grafts it would be possible to reduce the number of trees affected with crown-gall. In the following table the total number of trees dug is given; also the kind of wrapping, and the number and percentage of smooth trees, crown-gall trees, and hairy-root trees:

TABLE II.—*Comparison of smooth trees and trees affected with crown-gall and hairy-root, resulting when different methods of grafting were used.*

Kind of wrapping.	Total number.	Smooth trees.		Crown-gall trees.		Hairy-root trees.	
		Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Rubber	675	584	86.5	65	9.6	26	3.9
Cloth	709	604	85.1	70	9.8	35	5.1
Waxed paper	671	474	70.6	168	25.0	29	4.4
Plain thread	645	442	68.5	130	20.2	78	11.3
Waxed thread	675	430	63.7	182	27.0	68	9.3
Plain thread with union waxed	402	178	44.2	193	48.1	31	7.7
Unwrapped	569	312	54.8	200	35.2	57	10.0

A study of this table will show that the wrapping reduced the number of crown-gall trees very materially, but the results given should be considered as preliminary and the figures as relative rather than absolute. Only a small number of the trees under test have so far been dug. The remainder will be dug after one or two years' growth.

The most effective wrapping, so far as the true crown-gall is concerned, was that made of rubber (86.5 per cent of smooth trees), followed closely by cloth (85.1 per cent of smooth trees). The cloth wrapping, however, shows the highest percentage of smooth trees per 100 grafts planted when not only the crown-gall but also the hairy-root are considered. The difference is very slight, however. The other wrappings show less favorable results, least of all in the case of the grafts wrapped with plain thread and covered with grafting wax (44.2 per cent of smooth trees), followed closely by those with no wrapping whatever (54.8 per cent of smooth trees).

RECOMMENDATIONS.

From the results so far obtained, the use of either cloth or rubber as material for wrapping apple grafts is recommended. Owing to the expense involved in the use of rubber, cloth will be found the most desirable, and in most cases will probably give results fully as satisfactory as rubber. The writers strongly advise against the wrapping of grafts with thread and subsequently waxing the grafts.

SUGGESTION TO NURSERYMEN.

The results obtained from the experimental plats having shown that the wrapping has materially reduced the number of crown-gall and other types of rough trees, it will be very desirable to test these results on a larger scale. The grafts in these experiments were all made with the greatest care, and it would seem probable that the number of smooth trees obtained was therefore larger than might be the case where commercial grafts are made. The latter are usually not fitted with as much care, either with respect to size of scion and root pieces or with regard to an even and close union in the freshly made graft. It is therefore urged that nurserymen generally test the wrapping of their grafts this winter, either with rubber or cloth, after the manner previously described.

Care should be taken in setting out grafts with different kinds of wrapping to treat them in the same manner, that is—

(1) Use the same variety of scion.
(2) Use the same stock of roots.
(3) Make the grafts at the same time.
(4) Plant the grafts on the same date.
(5) Plant in the same field or at least on similar soil.
(6) Cultivate all grafts alike.

Where such tests are made, it is requested that the Bureau of Plant Industry be informed, so that all the experiments may be compared.

It may prove of interest to estimate the total number of smooth and rough trees to the acre which would result from the use of various wrappings, estimating 18,000 grafts to the acre and using as a basis the percentages of such trees obtained in the tests described in these pages. By smooth trees are meant trees free from crown-gall and other diseases; by rough trees, trees affected with true crown-gall, hairy-root, or manifestations of other diseases at or near the point of union. This estimate has been attempted in the following table, which should be regarded only as suggestive, however. The results are averaged from five identical plats in four different States, containing about 9,000 grafts.

TABLE III.—*Estimate of the number of smooth trees and rough trees which can be raised on an acre of land by using various methods of grafting.*

Wrapping.	Smooth trees.	Rough trees.	Total trees.
Rubber	12,600	1,980	14,580
Cloth	12,960	2,340	15,300
Waxed paper	10,260	4,320	14,580
Plain thread	9,540	4,320	13,860
Waxed thread	9,360	5,220	14,580
Plain thread with union waxed	3,780	4,860	8,640
Unwrapped	6,660	5,580	12,240

SUMMARY.

(1) The crown-gall disease of apple trees usually appears at or near the union of the scion and root piece.

(2) The crown-gall disease may be due to an excessive growth of callus, or to an infection of fungi, bacteria, or other agencies at or near the union.

(3) Protection of the graft at the union will serve to induce a better union and may also aid in keeping out disturbing factors.

(4) In making grafts care should be taken to use root and scion pieces of as nearly the same size as possible.

(5) Grafts wrapped with cloth and with rubber yielded 85.1 per cent and 86.5 per cent of smooth trees, respectively.

(6) Ordinary thread grafts yielded 68.5 per cent of smooth trees; plain thread grafts with the union waxed, 44.2 per cent; grafts with no wrapping, 54.8 per cent.

(7) It is recommended that apple grafts be wrapped with cloth or rubber.

B. P. I.—204.

III.—GARLICKY WHEAT.

By J. W. T. Duvel, *Assistant in the Seed Laboratory.*

INTRODUCTION.

Wild garlic (*Allium vineale* L.) was introduced into the United States from Europe considerably more than a century ago. Since its introduction it has made a slow but steady advance, and is now found growing more or less abundantly throughout the greater part of West Virginia, Virginia, Maryland, Delaware, Tennessee, North Carolina, the northern part of South Carolina, the southern part of Pennsylvania, New Jersey, and Connecticut, and locally in almost every State east of the Mississippi River. In all places where it has become well established it is a veritable pest to farmers, millers, grain dealers, and dairymen.

Wild garlic is one of the worst weeds to eradicate after it has once gained a foothold, being propagated by underground bulbs, aerial bulblets, and in some sections by seeds.

WHEAT CONTAINING GARLIC.

The presence of wild garlic in the grain fields of the central eastern States and in other sections where it is locally abundant has caused a very great loss to agriculture. Farmers have been obliged to sell their garlicky wheat at greatly reduced prices, principally because foreign markets will not buy it except at a low price, and millers as a rule refuse to handle it, for they have been able to grind garlicky grain only at a much increased cost. The garlic bulblets gum the rollers, necessitating the stopping of the mills and the washing of the rollers before the grinding can be resumed. The frequency with which the washing must be done depends on the quantity of garlic present. In extreme cases the washing must be repeated every two or three hours, the operation requiring from ten to fifteen minutes for each set of rollers.

Furthermore, flour made from wheat mixed with garlic bulblets is of inferior quality, as bread made from such flour has the garlic odor so disagreeable to most people. This is especially noticeable if the bread is eaten warm. Moreover, on boards of trade, wheat containing garlic bulblets in considerable quantity is graded as "Rejected," and is then sold only on sample. Wheat of this character is generally sold at a price ranging from 20 to 40 per cent lower than No. 2 Red. However, if the garlic bulblets are present only in comparatively small quantity (usually less than one-fourth of 1 per cent) it may pass as No. 2 Red, depending largely on the other foreign substances present and the amount of water in the grain.

At present there are no available data showing definitely the extent of the loss due to the presence of garlic in grain; but in wheat alone this loss is known to be very great. In many sections the growing of wheat has been almost wholly abandoned as a result of the reduced price at which garlicky wheat must be sold. An annual loss of $1,500,000 is undoubtedly a very conservative figure. It has been estimated by members of the Chamber of Commerce of Baltimore that 60 per cent of the wheat grown in that section of the United States contains more or less garlic. The three States in which garlic does the greatest injury to the wheat crop are Maryland, Virginia, and Tennessee. The average yield of wheat from these three States during the five years from 1900 to 1904, inclusive, was just short of 29,000,000 bushels. Allowing that 50 per cent of this wheat contains garlic, we have 14,500,000 bushels of garlicky wheat in these three States alone. But granting that only one-half of this amount contains garlic in sufficient quantity to throw it out of grade, we still have 7,250,000 bushels of wheat which must be sold at a greatly reduced price. A reduction of only 15 cents per bushel means more than a million dollars annually to the farmers of Maryland, Virginia, and Tennessee. The members of a prominent firm of grain exporters in Baltimore state that the depreciation for the Maryland crop alone, which amounts to about 12,000,000 bushels annually, will be fully 5 to 10 cents per bushel, or an equivalent of $600,000 to $1,200,000. A large quantity of garlicky wheat, however, does not get into the elevators, being fit only for feeding purposes. Mr. R. L. Wells[a] states that, in Tennessee, wheat containing garlic bulblets has been sold as low as 15 cents per bushel to feed stock.

EXPERIMENTS IN SEPARATING GARLIC FROM WHEAT.

The presence of the aerial bulblets of wild garlic in wheat has always been objectionable, principally because of the extreme difficulty of separating them from the wheat. While some of the lighter, immature bulblets can be blown out by a good fanning mill, the greater number are of practically the same size and weight as the wheat kernels. Plate I shows wheat kernels and the aerial bulblets of wild garlic of natural size. This similarity in size and shape makes it impossible to separate them during the autumn or early winter by the use of the ordinary cleaning machinery usually found in the majority of flour mills and elevators, i. e., by screening and fanning. If the bulblets

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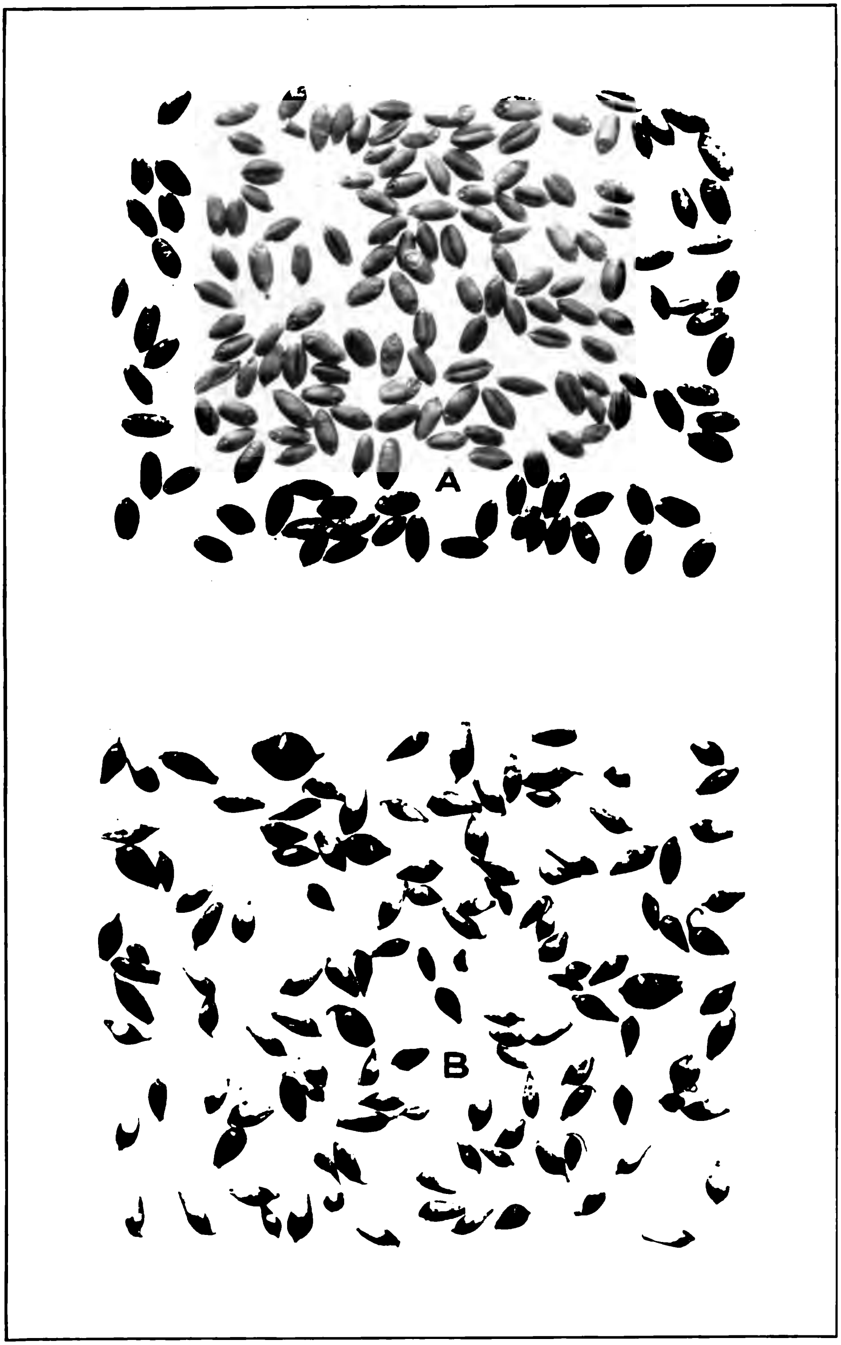
[a] The Wild Onion, Bulletin, Tennessee Agricultural Experiment Station, July, 1895.



WHEAT KERNELS (A) AND THE AERIAL BULBLETS OF WILD GARLIC (B).

(Natural size.)

are allowed to freeze, they afterwards become dry and are then quite readily blown out, but this is not always practicable.

In view of this fact experiments were undertaken in June, 1905, in order to ascertain whether the mixture of garlic and wheat could not be dried artificially, thereby reducing the weight of the bulblets to such an extent that they could be satisfactorily removed as soon as the grain is ready for market. The detailed results of these experiments[a] are given in the following pages.

LOT A.

Lot A consisted of approximately 44 bushels of "rejected" wheat furnished by the Baltimore Chamber of Commerce. When received it contained 16.55 per cent of water and 2.17 per cent of garlic. The amount of foreign seed and chaff present was not determined. The value of this wheat was placed at 65 or 70 cents a bushel.

Experiment No. 1.—A portion of this wheat was dried in the small grain drier of the Seed Laboratory at a maximum temperature of 136° F. for two hours. During this time the moisture content of the grain was reduced from 16.55 per cent to 9.5 per cent, or from 2½ to 4½ per cent less than good American wheat normally contains. But this degree of drying proved insufficient, as 0.28 per cent of garlic still remained in the sample after a preliminary cleaning. This same lot of wheat was therefore dried for an additional half-hour and the moisture content was reduced to 8.94 per cent.

Experiment No. 2.—Another portion of seed from Lot A was dried a few days later for nearly four hours, the maximum temperature reading 140° F. At the termination of the drying a moisture determination of a sample of this wheat showed only 5.87 per cent of water.

The wheat from experiments Nos. 1 and 2 was then mixed and cleaned, and the average percentage of water in the mixed sample was found to be 7.41 per cent. After cleaning, an analysis of this wheat showed that the amount of garlic had been reduced from 2.17 to 0.05 per cent, 97.6 per cent of the garlic having been removed. Plate II, figure 1, shows a 1-pound sample of this wheat as received, the quantity of garlic in 1 pound when received, and the quantity of garlic remaining in 1 pound after drying and cleaning.

Concerning this lot of wheat the secretary of the Baltimore Chamber of Commerce wrote as follows:

> The wheat which you cleaned and returned was the source of a great deal of interesting comment upon the floor of the chamber, and the general idea is that a very vast change was accomplished by running it through the drier. The sample sent originally was of such low

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[a] Acknowledgments are due to the members of the Baltimore Chamber of Commerce and to Mr. Walter Roberts, of Alexandria, Va., and Mr. E. H. Darby, of Seneca, Md., who kindly supplied the garlicky wheat for these experiments.

and inferior grade as to prohibit it from going into the elevators, and the drying and cleaning to which it was subjected made it No. 2 Red, the contract grade, a difference in value of fully 17 cents per bushel.

An increase of 17 cents per bushel was equivalent to 24.6 per cent of the value of this wheat before drying and cleaning.

LOT B.

A second sample of approximately 38 bushels of "rejected" wheat furnished by Mr. Walter Roberts, Alexandria, Va., contained 0.56 per cent of garlic and 15.08 per cent of water and weighed only 57.5 pounds per bushel.

The lot was divided into three parts for treatment, as follows:

Experiment No. 3.—In this test the drying was continued for three hours, the temperature of the air varying from 153° to 158° F. and the temperature of the wheat from 117° to 155° F. The moisture was reduced from 15.08 to 7.92 per cent. The weight per bushel was increased from 57.5 to 59.25 pounds on drying and to 60.6 pounds after cleaning. The quantity of garlic was reduced to 0.05 per cent, the same as the combined results of experiments Nos. 1 and 2.

Experiment No. 4.—The period of drying in this experiment extended over three and one-half hours, the temperature of the air being the same as in experiment No. 3, 153° to 158° F., the temperature of the wheat gradually increasing from 95° F. at the end of the first half-hour to 145° F. During the three and one-half hours' drying, the water content of the wheat was reduced to 6.88 per cent and the weight per bushel increased to 59.5 pounds. After cleaning, the weight per bushel was increased to 60.7 pounds and the quantity of garlic reduced from 0.56 per cent to 0.06 per cent. Plate II, figure 2, shows a 1-pound sample of this wheat as received, the amount of garlic in 1 pound when received, and the amount of garlic remaining in 1 pound after drying for three and one-half hours and cleaning.

Experiment No. 5.—The last portion of Lot B was dried for two and three-fourths hours, the temperature of the wheat reaching 122° F. in three-quarters of an hour, and 138° F. after one hour, which temperature was maintained for one-half hour, gradually decreasing during the last one and one-quarter hours to 117° F., when the experiment was concluded. The moisture content of the wheat was reduced from 15.08 to 8.48 per cent and the weight per bushel raised from 57.5 to 58.6 pounds. After cleaning, the weight per bushel was 60 pounds and the garlic present 0.07 per cent.

After drying and cleaning, the wheat from Lot B graded No. 2 Red, having at that time a value of 85 cents per bushel. As in its original condition the wheat was purchased for 55 cents per bushel, the drying and cleaning increased its value 54.5 per cent.

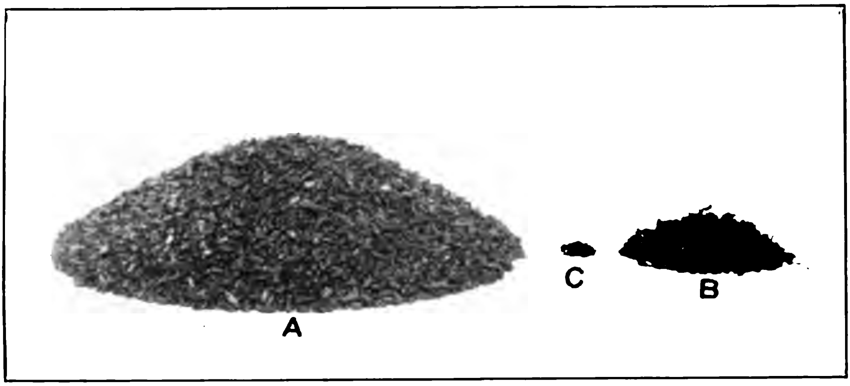


FIG. 1.—WHEAT AND GARLIC FROM LOT A.

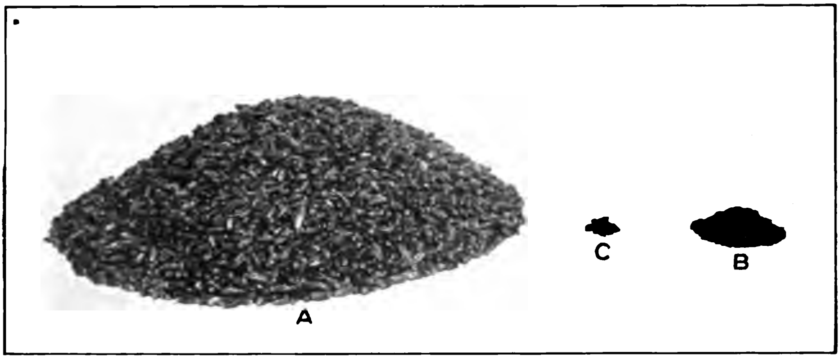


FIG. 2.—WHEAT AND GARLIC FROM LOT B.

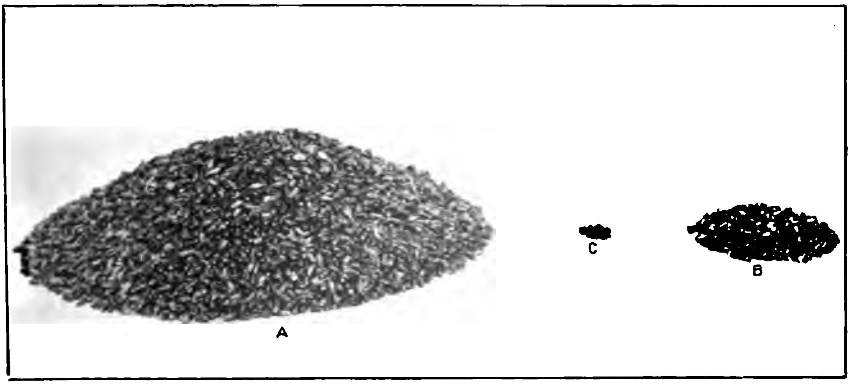


FIG. 3.—WHEAT AND GARLIC FROM LOT C.

ONE-POUND SAMPLES OF GARLICKY WHEAT AS RECEIVED (A, A, A); THE QUANTITY OF GARLIC IN ONE-POUND SAMPLES WHEN RECEIVED (B, B, B); THE AMOUNT OF GARLIC REMAINING IN ONE-POUND SAMPLES AFTER DRYING AND CLEANING (C, C, C).

LOT C.

A consignment of approximately 30 bushels of "rejected" wheat, containing 2.04 per cent of garlic, 16.2 per cent of water, and weighing only 56.5 pounds a bushel, was lent to the Department of Agriculture by Mr. E. H. Darby, of Seneca, Md.

This lot of wheat was divided into two parts and treated as experiments Nos. 6 and 7.

Experiment No. 6.—This wheat was subjected to an air temperature of 113° F. for one hour and of 154° F. for two hours, the maximum temperature of the grain for the last half hour being 149° F. The moisture content was reduced from 16.2 per cent to 8.2 per cent. The weight per bushel was raised to 57.8 pounds after drying and 60.6 pounds after cleaning, and the amount of garlic was reduced to 0.17 per cent.

Experiment No. 7.—This experiment continued for three hours, as in experiment No. 6, but the temperature of the air current decreased gradually from 146° to 122° F., the maximum temperature of the grain being 131° F. Samples taken at the termination of the experiment showed a moisture content of 8.83 per cent. The weight per bushel was increased to 57.5 pounds after drying and 60.2 pounds after cleaning. Plate II, figure 3, shows a 1-pound sample of this wheat as received, the amount of garlic in 1 pound when received, and the amount of garlic remaining in 1 pound after drying for three hours and cleaning.

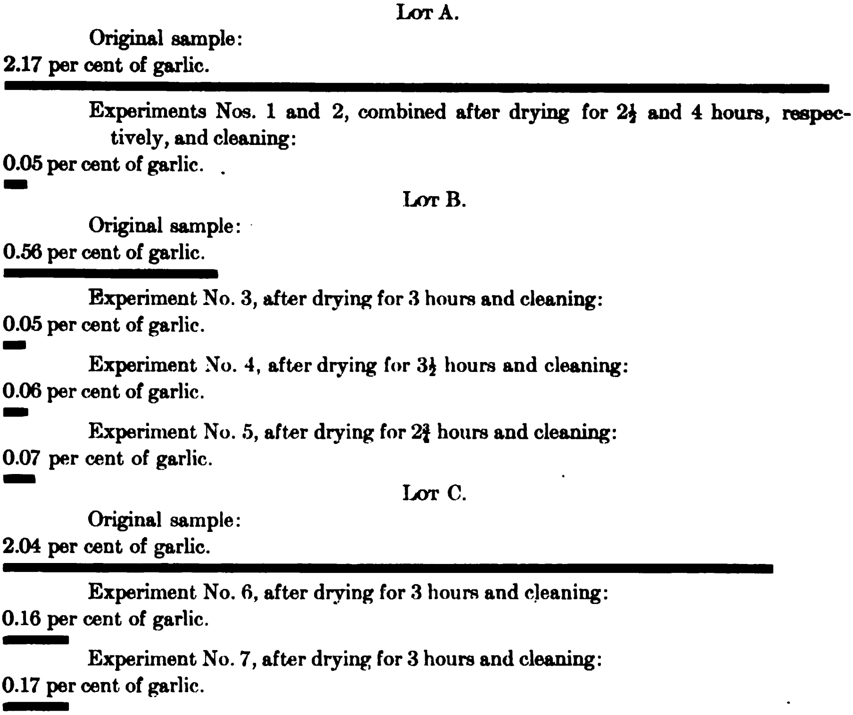
A sample of this cleaned wheat was examined by the chief inspector of the Baltimore Chamber of Commerce and graded as No. 2 Red, giving it a value of 84.5 cents per bushel. The highest price offered for the original lot of wheat was 60 cents per bushel. The removing of the garlic and the cleaning consequently enhanced the value 40.8 per cent.

In experiments Nos. 6 and 7 the drying was not continued quite long enough for the best results, although the quality of the wheat was raised to "contract" grade. At temperatures from 150° to 158° F. the drying should continue for two and one-half to three hours, or until the moisture content of the wheat is reduced to about 8 per cent.

In none of the experiments was it possible to remove all of the garlic, but in every case the quantity was reduced considerably more than was necessary to make the wheat grade as No. 2 Red. Moreover, the quantity of garlic present after the cleaning was not considered sufficient to interfere with the milling of the wheat or to injure the quality of the flour.

The following diagrammatic figures show the relative quantity of garlic in the wheat before and after treatment:

Percentages, by weight, of garlic in wheat, Lots A, B, and C, before and after drying and cleaning.



Garlic bulblets as found in wheat contain from 35 to 70 per cent of water, while the water content of fresh garlicky wheat usually varies from 15 to 20 per cent. During the drying the amount of water in the wheat is decreased, but at the same time the kernels become more compact and the specific gravity is increased, as is shown by the weight per bushel before and after drying. On the other hand, the specific gravity of the garlic bulblets is lowered by the drying. The outer membranous coverings of the bulblets remain distended and the shrinkage takes place in the inner portion, thus leaving a small air space between the bulb proper and the outer protecting layers. This increased air space, together with the decreased weight due to the loss of water, makes it possible to separate most of the bulblets from the wheat by ordinary cleaning machinery.

THE TOTAL COST OF DRYING AND CLEANING GARLICKY WHEAT.

The total cost, including the shrinkage, of drying and cleaning any given lot of wheat for the removal of garlic depends on four factors: (1) The amount of garlic removed; (2) the amount of chaff and other foreign substances, aside from the garlic, removed; (3) the percentage of water removed from the wheat; (4) the cost of operating the machinery.

The amount of garlic removed.—In the experiments with the three lots of wheat herein described practically all of the garlic was removed, and this must be considered as a loss in weight. The average loss for each of the three lots of wheat due to the removal of garlic was 2.12 per cent, 0.50 per cent, and 1.88 per cent for Lots A, B, and C, respectively.

The amount of chaff and other foreign substances, aside from the garlic, removed.—The loss in weight due to the cleaning, aside from the quantity of garlic, depends entirely upon the amount of light, immature wheat, chaff, and other foreign substances removed. This loss bears the same ratio for any lot of wheat. Consequently, strictly speaking, this additional decrease in weight can not be considered as an extra expense in the treatment of garlicky wheat. Moreover, the quantity of foreign substances present has an important bearing on the grading of the grain.

The following summary shows the percentages of screenings, including the garlic, obtained from the wheat treated as experiments Nos. 3, 4, 5, 6, and 7:

Experiment No. 3 gave 611 pounds of clean wheat and 28 pounds, or 4.4 per cent, of screenings. Experiment No. 4 gave 548.5 pounds of clean wheat and 15.5 pounds, or 2.8 per cent, of screenings. Experiment No. 5 gave 736.5 pounds of clean wheat and 26.5 pounds, or 3.4 per cent, of screenings. The average percentage of screenings from experiments Nos. 3, 4, and 5 (Lot B) was 3.54 per cent. Deducting from this the amount of garlic removed from Lot B, 0.50 per cent, there is left 3.03 per cent, the proportion of immature wheat, chaff, and other foreign substances removed.

In experiments Nos. 6 and 7, 1,536 pounds of dried wheat gave 135 pounds of screenings, an equivalent of 8.8 per cent, of which 1.88 per cent was garlic, leaving 6.92 per cent of immature wheat, chaff, and other foreign substances removed.

The percentage of water removed from the wheat.—Garlicky wheat almost invariably contains a high percentage of water, and the greatest loss in weight is probably due to the liberation of water during the drying process. In these experiments the quantity of water was reduced from 16.55 per cent, 15.08 per cent, and 16.20 per cent to an average of 7.41 per cent, 7.76 per cent, and 8.52 per cent for Lots A, B, and C, respectively. In order that the garlic may be removed satisfactorily it is necessary to reduce the water content to approximately 8 per cent, which is from 4 to 6 per cent less than No. 2 Red wheat normally contains. However, the dried wheat will again absorb water from the atmosphere, and after the lapse of a few days the water content will be practically the same as that of air-dried wheat. Likewise the clean, dried wheat can be mixed with any garlic-free lot of wet wheat and the grade of the latter improved in this way. For this reason, only the difference between the water content of the wet garlicky wheat and that of No. 2 Red, which averages about 13 per cent during the first few months after harvesting, should be considered as actual loss in weight due to drying. On this basis the loss due to the removal of water was 3.55 per cent for Lot A, 2.08 per cent for Lot B, and 3.20 per cent for Lot C.

The cost of operating the machinery.—The cost of the actual drying and cleaning alone is very small. With the low pressure boilers available for use with the small grain drier in the Bureau of Plant Industry the maximum temperature possible is only 158° F. At this temperature it is necessary to continue the drying for from two and one-half to three hours in order that the weight of the garlic may be sufficiently reduced so that it can be removed. With the high pressure boilers such as are found in most grain elevators and flour mills an air temperature of 170° to 180° F. can be readily maintained, at which temperature the time factor can be greatly reduced. By careful calculation it is believed that the actual cost of operating the machinery for the drying and cleaning should not exceed one-half cent per bushel.

This factor, however, will vary with the capacity of the drier and the number and size of the other kinds of machinery being operated simultaneously by the same boilers.

THE NET COST OF REMOVING GARLIC.

To ascertain the net cost of removing garlic bulblets from wheat in order to bring it up to "contract" grade, only the following items need be taken into consideration: (1) The cost of operating the machinery; (2) the loss in weight due to the quantity of garlic actually removed, and (3) the difference in the amount of water normally contained in good air-dried wheat, which is not far from 13 per cent, and the amount of water in the garlicky wheat before it goes into the drier. On this basis the cost of drying and cleaning the garlicky wheat discussed in the foregoing pages was 6.3 per cent, 3.2 per cent, and 5.7 per cent, or an equivalent of 5½ cents, 2¾ cents, and 4⅘ cents per bushel for lots A, B, and C, respectively, as governed by the prices current at that time.

THE EFFECT OF THE DRYING ON THE MILLING QUALITIES OF THE GRAIN.

No flour was made from any of the wheat after drying and cleaning; but the consensus of opinion of the majority of the millers to whom samples of the dried wheat were submitted was that the milling qualities of the wheat had not been injured by the drying. Such wheat, however, is not fit for milling until it has absorbed water from the atmosphere, or has been mixed with damp grain, or steamed, in order to toughen the bran. If the milling is attempted while the wheat is exceptionally dry, the bran will be easily broken, resulting in the production of coarse, dark flour.

THE EFFECT OF THE DRYING ON THE VITALITY OF THE WHEAT.

The objection has frequently been made that the high temperature ordinarily used in the commercial drying of grain will destroy the germinating power. In the majority of cases the vitality of the grain after drying is of little importance, as such grain is seldom used for sowing or planting. The foregoing objections, however, are not well established, as the vitality of grain is not injured by drying in commercial grain driers at the temperatures commonly employed.

The grounds for the belief that temperatures as high as 140° to 175° F. for periods of short duration will destroy the vitality of grains are based on laboratory tests in which no provision was made for the circulation of air. Under such conditions the life-giving principles are readily destroyed, especially when considerable moisture is present. But when the drying is done in such a way that the moisture liberated will be readily carried away, as in commercial grain driers, there is little danger of destroying the vitality of the grains, even though the duration of drying be several times greater than that given for the foregoing experiments.

The following table shows the effect of the drying on the germinating capacity of the samples of garlicky wheat from lots B and C, already discussed:

Percentages of germination of wheat from lots B and C before and after drying.

Sample mark.	Duration of drying.	Temperature of air current in drying.	Maximum temperature of wheat.	Water content of wheat.	Germination.
	Hours.	*Degrees F.*	*Degrees F.*	*Per cent.*	*Per cent.*
Original sample				15.08	80
Experiment No. 3	3	153-158	155	7.92	83.5
Experiment No. 4	3½	153-158	145	6.88	85
Experiment No. 5	2¾	155-168	128	8.48	79.5
Original sample				16.20	82
Experiment No. 6	2½	113-154	149	8.20	83
Experiment No. 7	3	116-122	131	8.83	85

With but a single exception the percentages of germination were higher after the drying than before, and such is generally true. In all cases the germination was low, due to the damaged condition of the grain when received.

While the tests made are few in number, the results given in the foregoing table are sufficient to show that a good quality of garlicky wheat can be dried and afterwards cleaned and used for sowing with entirely satisfactory results. The garlic bulblets, as found in wheat, contain from 35 to 70 per cent of water. With this high percentage of water the greater quantity of the bulblets are partially cooked or scalded during the drying process, thus rendering growth impossible.

MACHINERY USED FOR DRYING AND CLEANING.

The drying was done in a small grain drier. In the absence of a good fanning and screening machine for the larger grains, the wheat was first run through a fanning mill specially constructed for cleaning clovers, alfalfa, and timothy. The greater quantity of the garlic was blown out, but many of the larger bulblets could not be removed in the absence of screens, and for this reason the wheat, for the final cleaning, was put through a "shaker" such as is commonly used for cleaning rice.

It is not desired to place any special emphasis on the particular machinery used for these experiments. Any of the good commercial driers with any good cleaning machinery should give satisfactory results.

SUMMARY.

The presence of the aerial bulblets of wild garlic in a large quantity of the wheat grown in the central eastern United States causes a great depreciation in its value. The loss to agriculture from this cause alone is very conservatively estimated at more than $1,500,000 annually.

The wheat kernels and the garlic bulblets are very similar in size and weight, which makes their separation by the methods ordinarily in use next to impossible as long as they are fresh.

If wheat containing garlic is artificially dried, the wheat kernels increase in specific gravity and the garlic bulblets decrease in specific gravity, so that practically all of the latter can be removed by good cleaning machinery.

Garlicky wheat is usually wet, often containing as much as 20 per cent of water, and the drying should be continued until the moisture is reduced to approximately 8 per cent.

In estimating the total cost of the treatment of a lot of garlicky wheat, only the amount of garlic removed, the excess of moisture above that which good No. 2 Red wheat usually contains, and the cost of operating the machinery need be considered. The cost of removing the chaff, immature wheat, etc., is the same as for the cleaning of any sample of wheat free from garlic.

The commercial drying of wheat in a good commercial grain drier does not injure its vitality, while most of the garlic bulblets are killed, owing to the higher percentage of water in the latter.

It has not been definitely determined, but the more general opinion is that the drying does not injure the milling qualities of the wheat.

Any of the good commercial grain driers, together with any good wheat-cleaning machinery, should give satisfactory results.

B. P. I.—212.

IV.—METHODS OF TESTING THE BURNING QUALITY OF CIGAR TOBACCO.[a]

By **Wightman W. Garner**, *Scientific Assistant, Plant Breeding Investigations.*

INTRODUCTION.

As has been pointed out in previous publications of the Bureau of Plant Industry, a systematic effort is being made to improve the quality and yield of the tobacco crop by employing the latest and most approved methods of selection in the old varieties and by creating and establishing new strains possessing to a marked degree those characteristics most to be desired in the various classes of tobacco which the market demands. This work necessitates the careful testing of a large number of types, as well as many individual selections from each of these types, and for this reason it is very desirable to have at our command methods capable of showing with certainty even slight differences in the essential qualities of the various samples to be examined. It is our purpose to make a careful study of the subject of testing tobacco from a practical standpoint, as well as the relation of the chemical composition of the leaf to its good and bad qualities.

In judging the merits of a cigar tobacco, due regard must be had for the particular use for which it is intended, since the finished cigar consists of three distinct components—the filler, the binder, and the wrapper—each of which must possess certain characteristics. The filler must have, above all else, a fine flavor and aroma and a good "burn." In the case of the wrapper leaf there are a number of requirements to be met, among which are sufficient elasticity, proper color, size, and shape, fineness of veins, freedom from objectionable flavor and taste, a fine "grain," and a good burn. Many of these qualities can be determined by simple inspection, without the use of any specific tests, while others require special laboratory methods. The present article has to do only with the practical methods of testing the burn, deferring to a later day a consideration of the chemical characteristics of the tobaccos which have been tested.

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[a] In the tobacco breeding experiments conducted by the Plant Breeding Investigations of the Bureau of Plant Industry, particular attention is being given to the improvement of cigar tobaccos, including specially high-grade wrapper and filler types. In connection with these experiments, which are being conducted by Messrs. A. D. Shamel and W. W. Cobey, of this office, it has been found necessary to compare the characters of a large number of selected individual plants to determine which ones are superior in their important characters. The means and methods heretofore used in making such comparative tests were very imperfect, and one important preliminary part of the work is to devise special pieces of apparatus which will enable accurate tests to be made. The devices described by Dr. Garner in the present paper it is believed will greatly facilitate such testing and add to the accuracy of the results. The preliminary notes given by Dr. Garner on the influence of wrapper, binder, and filler on the "burn" of cigars open up an important field of investigation in connection with the testing and breeding of different types of tobacco.—Herbert J. Webber, *Physiologist in Charge of Plant Breeding Investigations.*

There are several elements which go to make a good or bad burn, chief of which are the capacity for holding fire, the evenness of the burn, the color of the ash and its firmness, the coaling or carbonization, and the "puckering" of the leaf immediately in advance of the burning zone of the cigar. The final test of any cigar tobacco must, of course, rest in the smoking of the manufactured cigar, but, while this gives a direct means of determining the character of the ash, it does not furnish accurate information as to the evenness of the burn or the fire-holding capacity of any one of the components of the cigar except with reference to the other two particular components used in the experiment. This is particularly true of the wrapper, as was shown by special experiments carried out to observe the effect of using different fillers and binders with the same wrapper. The result of these experiments will be more fully discussed below. Again, it should be remembered, in this connection, that cigars made by the same workman and from the same lot of tobacco often vary widely in their burn owing to the impossibility of avoiding unevenness in the filler, and this source of error can only be eliminated by several times repeating the experiment. It is evident, therefore, that, in order to get reliable data concerning the relative merits of different wrappers with respect to their burning qualities, the cigar test must be supplemented by some other method capable of giving sharp distinctions as to the fire-holding capacity and evenness of burn.

A method which has long been in use is to ignite the leaf by means of a lighted cigar or a slow-burning match devised by Nessler,[a] and note the number of seconds during which it continues to glow. The mean of several tests is taken as a measure of the capacity for holding fire; but the variation in the results obtained, even upon a single leaf, is so great that little reliance can be placed upon the figures except in a very general way. In this method no account is taken of the area of the leaf burned, and the wide differences obtained on a single leaf are due principally to the fact that frequently the ignited zone soon ceases to glow except for one or more very small streamers, which continue to burn for a much longer period, thereby giving results altogether out of proportion to the true burning qualities of the tobacco in question. Another serious objection to the method is found in the interference of the veins of the leaf; for it seldom happens that the glow can cross these veins except around the outer edges of the leaf, while in the cigar the veins always run longitudinally and so do not interfere with the burn.

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[a] Landw. Vers. Stat., XI, 399.

The rational procedure would seem to be to test the burn of the leaf when wrapped in some such form as is actually found on the cigar, but without the use of binder or filler. We have devised a method of this kind in which the leaf, after being properly wrapped and dried, is burned with the aid of a slow current of air. The current of air compensates in a measure for the absence of the filler and binder, while its use obviates the unavoidable irregularities of the latter. A detailed description of the apparatus used and the method of carrying out the operation will be found on page 37. This test, combined with the smoking of the cigar, has enabled us to accurately classify a large number of samples of wrapper leaf with respect to their burning qualities.

THE SMOKING TEST.

It is evident that no two persons would smoke a cigar in exactly the same way, nor would the same individual smoke two cigars under exactly similar conditions. It is necessary, therefore, to use some means of smoking the cigars artificially in order to eliminate the personal equation and secure uniformity of conditions. Dr. E. H. Jenkins, in the Annual Report of the Connecticut Agricultural Experiment Station for 1892, has described an apparatus for smoking cigars which was devised by Mr. S. L. Penfield, of Yale University. The "pull" on the cigar is secured by means of an aspirator which is filled by a continuous inflow of water and emptied at regular intervals by a siphon. We have modified this apparatus in a number of details in order to adapt it to our needs, and we give herewith a description of the form and dimensions which we have finally adopted for use in our investigations. In this apparatus as many as four cigars may be smoked simultaneously, while held in such a position that they may be readily compared throughout the operation.

By reference to the accompanying illustration (fig. 2) it will be seen that the holders (*a*, *b*, *c*, and *d*) for the cigars are so arranged that they all lie in the same vertical plane, each one 2 inches above and having its horizontal arm 2 inches shorter than the next lower. A screen with a white covering is placed immediately in the rear of the holders to serve as a background, thereby facilitating observation of the character of the ash. Between the flask bearing the holders and the aspirator and connected with these by means of glass tubing is a

THE PHILADELPHIA
JUN 10 1907

check valve consisting of a T-tube (*e*), the lower arm of which dips beneath the surface of the water in a suitable vessel (*f*), thus preventing a backward draft through the cigars while the aspirator is filling. The smoke which escapes through this valve has a very disagreeable odor; hence, it is well to use a bottle fitted with a stopper with two holes, through one of which passes the lower arm of the T-tube (*g*), while through the other passes one end of a long tube (*h*), which carries away the obnoxious fumes. The aspirator consists of a glass cylinder (*i*), the upper end of which is fitted with a rubber stopper containing two holes through which pass tubes leading to the water supply (*k*) and to the flask carrying the cigar holders (*l*), respectively. The lower end of the cylinder is closed with a rubber stopper bearing the small arm of the siphon (*o*). The tube furnishing the water supply is connected with a reservoir provided with a constant-level attachment. To the lower end of the small arm of the siphon is attached a glass tube (*m*) bearing a small bulb which materially assists in breaking the flow of the water at the moment the aspirator is emptied. The tubing connecting the parts of the apparatus should not be less than

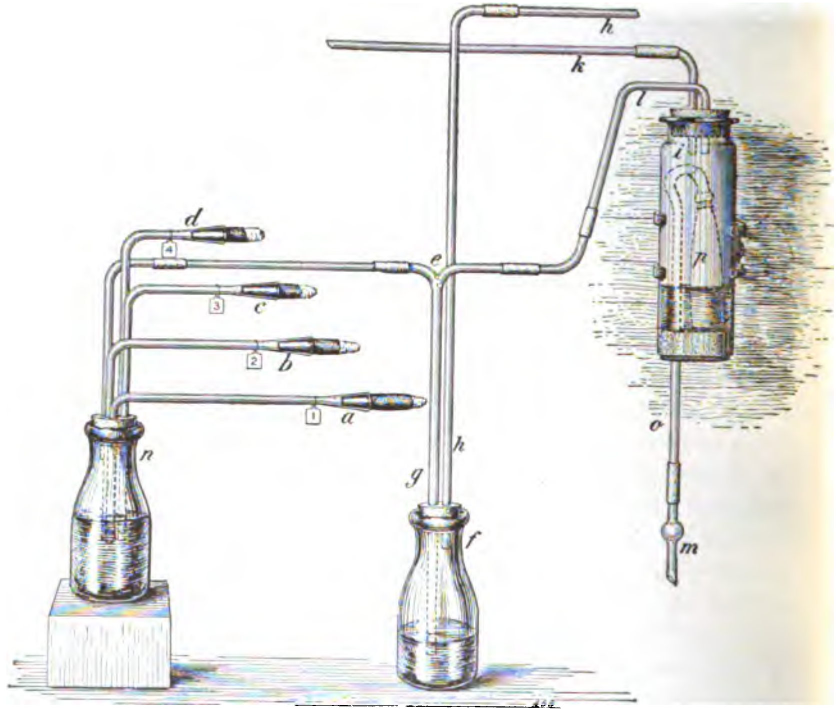
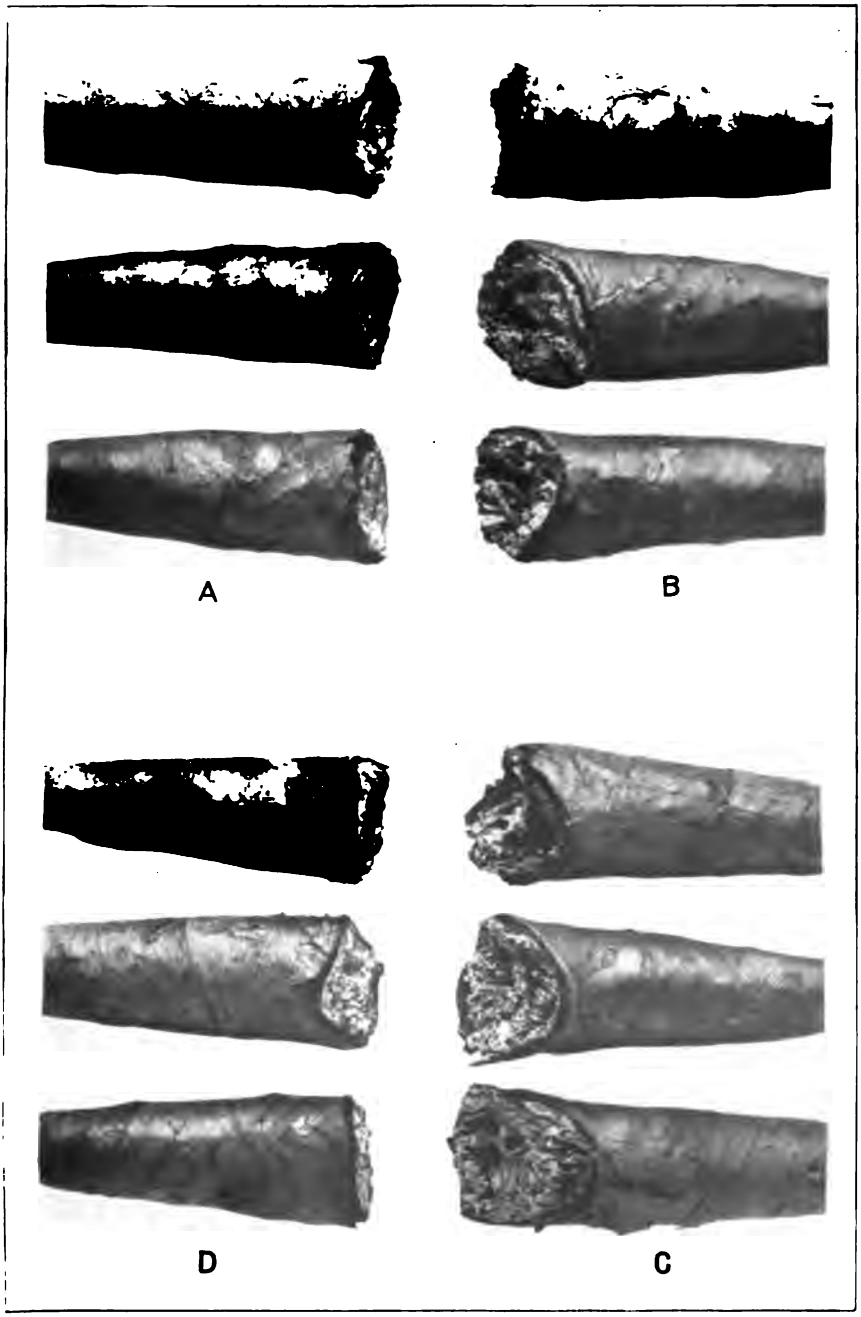


FIG. 2.—Apparatus for testing the burning quality of cigars: *a*, *b*, *c*, *d*, holders for cigars; *e*, T-tube, the lower arm of which, *g*, dips beneath surface of water in *f*; *h*, *h*, tube for leading away tobacco smoke; *i*, aspirator; *k*, tube leading to water supply; *o*, *p*, long and short arms of siphon; *l*, tube connecting cigar holders with aspirator; *m*, tube, with bulb, attached to long arm of siphon; *n*, flask carrying the cigar holders.



VARIATION IN BURN OF WRAPPERS DUE TO DIFFERENT FILLERS: A, FILLER GROWN IN TEXAS FROM CUBAN SEED; B, FILLER GROWN IN OHIO FROM DOMESTIC SEED; C, FILLER GROWN IN SOUTH CAROLINA FROM CUBAN SEED; D, AN IMPORTED CUBAN FILLER.

The same sample of Sumatra wrapper was used throughout and the binder was taken from the same leaf as the wrapper in each case.

6 to 8 mm. internal diameter; otherwise the tubes will frequently become clogged by the condensation products of the smoke. The container for the cigar holders (*n*) is filled about two-thirds full with dilute sulphuric acid, which serves as an acid wash for the smoke, retaining the organic bases and thereby further helping to prevent the choking up of the machine. The lower ends of all the cigar holders should, of course, extend to exactly the same depth below the surface of the acid.

In the machine which we now have in operation, the relation between the short arm of the siphon and the internal diameter of the aspirator is such that the volume of water delivered at each emptying of the latter is 600 c.c. This corresponds to an actual capacity of about 450 c.c. for the aspirator, the difference, of course, representing the volume of water entering the aspirator from the supply pipe while the siphon is in action. The rate of inflow from the supply tank is approximately 900 c. c. per minute. The internal diameter of the long arm of the siphon is 8 mm., while that of the short arm is 25 mm. The entire length of the long arm of the siphon exceeds that of the short arm by 40 cm. An apparatus of the above-mentioned dimensions will smoke four cigars of the Perfecto type, 4¾ inches in length, in about thirty minutes, a rate which is probably somewhat above that of the average smoker. The pull on the cigar occurs at intervals of thirty seconds and continues for a period of ten seconds. The frequency of the pull is controlled by the rate of inflow of the water from the supply tank, while its duration is governed principally by the relation between the diameter of the small arm of the siphon and the volume of the aspirator.

THE EFFECTS OF THE FILLER, THE BINDER, AND THE WRAPPER ON THE BURN OF THE CIGAR.

As preliminary to the use of the cigar test in examining wrapper leaf, a series of experiments was carried out to determine the relative effects of the three components of the cigar on the burn. For this purpose a number of cigars were made by an expert workman, using four different types of wrapper on each of four different types of filler. In a portion of the cigars the binder used was taken from the same leaf as the wrapper, while in the remainder a sample of Connecticut Broadleaf tobacco was employed for this purpose. These cigars were smoked in the above-described apparatus under conditions as nearly uniform as could be obtained, and the evenness of the burn and the character of the ash were carefully noted.

With reference to the evenness of the burn, markedly different results were obtained when wrappers taken from the same sample were smoked on different types of filler. A typical case of this kind is shown in Plate III. The twelve cigars shown were all made from the same sample of wrapper, and in each case the binder was taken from the same leaf as the wrapper. In the first group (A), a sample of filler grown in Texas from Cuban seed was used; in the second group (B), a heavy filler grown in Ohio from domestic seed; in the third group (C), a filler grown in South Carolina from Cuban seed; in the fourth group (D), an imported Cuban filler. The wrapper used on these cigars was a type of Sumatra tobacco grown in Connecticut and had a very good burn. The Texas and imported Cuban fillers were known to have an excellent burn, while the South Carolina filler was markedly inferior in this respect and the Ohio filler intermediate in burning qualities. It will be seen that this sample of wrapper burned quite evenly when used with the imported Cuban and Texas fillers, while with the Ohio and especially the South Carolina fillers the burn was decidedly uneven.

On the other hand, the effect of using different types of wrapper on the evenness of burn of any one type of filler was less marked (see Pl. IV, A, B, and C; also Pl. III, D). The filler used in this experiment was the imported Cuban, while the wrappers were taken from four different types of Sumatra tobacco grown in Connecticut. Of these four types of wrappers, that shown in Plate III, group D, had the best burn and the one shown in Plate IV, group C, the poorest, although little difference could be seen between the two when smoked on the Cuban filler. The use of different binders did not cause any marked differences in the evenness of the burn, as is shown in Plate IV, groups C and D. The cigars used in this experiment were all made from the same wrapper and the same filler, while in group D a sample of Connecticut Broadleaf tobacco was used as the binder, and in group C the binder was taken from the same leaf as the wrapper.

Another important factor in determining the evenness of the burn is the proper balancing of the component parts of the cigar. It was found, for example, that a very light[a] wrapper will not give good results on a heavy filler, even though both of these may in themselves possess a good burn. It will readily be seen that a very thin wrapper which burns readily and very rapidly will, when placed on a heavy, slow-burning filler, tend to burn in advance of the latter, and the effect will generally be an uneven burn. The same result is obtained when any cigar is smoked very rapidly, for the reason that the oxygen of the air has freer access to the outer edges of the burning zone and under the added stimulus it rarely happens that a cigar will burn evenly.

As regards the character of the ash, the wrapper and the binder are relatively of much more significance. It was found, it is true, that some fillers give an ash lacking in compactness and liable to split asunder, but the tendency to flake seems to be controlled almost entirely

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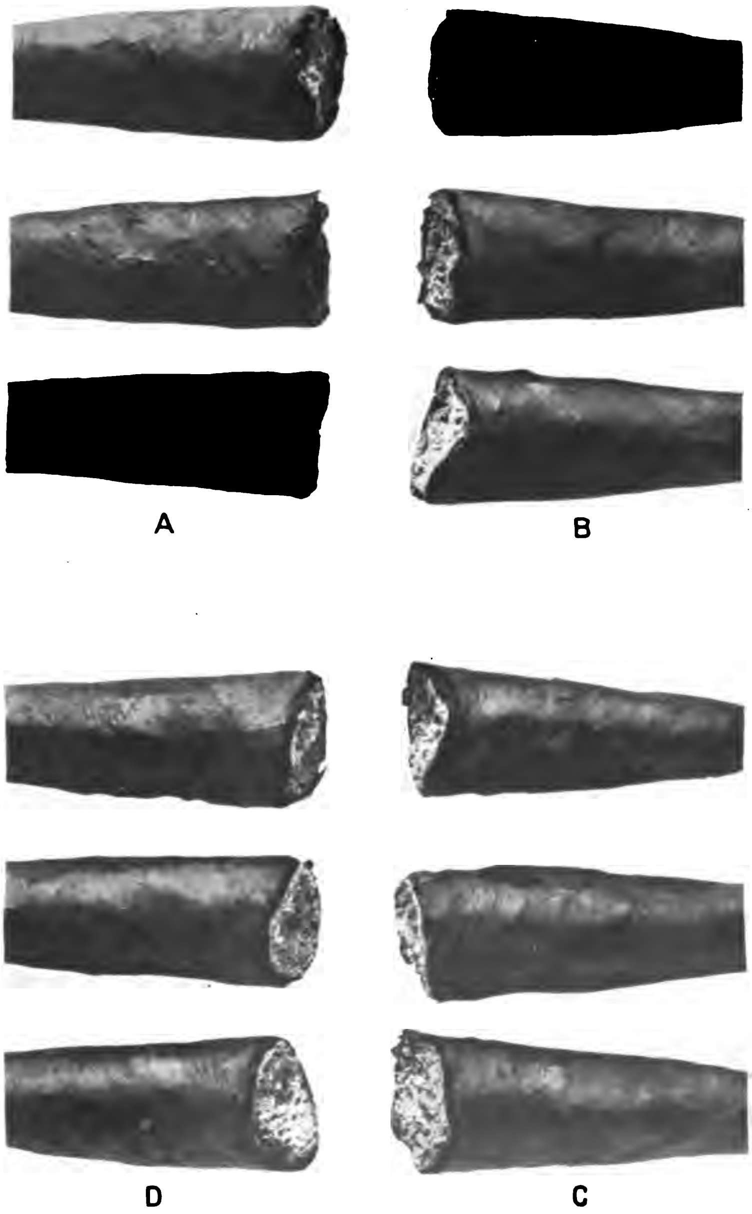
[a] The terms *light* and *heavy* as used in this connection refer to the body or thickness of the leaf, which largely controls the rapidity of the burn.



VARIATION IN BURN OF FILLERS DUE TO DIFFERENT WRAPPERS AND BINDERS: A, B, C, THREE DIFFERENT TYPES OF CONNECTICUT-GROWN SUMATRA WRAPPER ON SAME SAMPLE OF CUBAN FILLER, BINDER BEING SAME AS WRAPPER IN EACH CASE; D, SAME WRAPPER AND FILLER AS C, BUT CONNECTICUT BROADLEAF USED AS BINDER.

by the character of the wrapper and binder. Furthermore, this lack of cohesion in the ash of a wrapper may be largely overcome by the use of a good binder. As to the color of the ash, a binder having a good burn will impart to the ash of the wrapper a lighter tint and a more uniform color. The general results of these experiments may be summarized as follows:

(1) In order to secure a good burn, due consideration should be given to the proper balancing of the components of the cigar; that is, a heavy filler should be wrapped with a comparatively heavy wrapper, while a light-bodied filler requires a light-bodied wrapper.

(2) Of the three components of the cigar, the filler exerts the strongest influence on the evenness of the burn.

(3) The influence of the wrapper and binder is shown most strongly on the character of the ash, and the binder very materially influences the ash of the wrapper in this respect.

TESTING THE CAPACITY FOR HOLDING FIRE AND THE EVENNESS OF THE BURN.

The factors of holding fire and of burning evenly are of prime importance in judging the burn of tobacco, and any sample found markedly deficient in these points may be rejected without applying any further test. As has been previously stated, the old method of measuring the fire-holding capacity is likely to lead to erroneous conclusions, while there has heretofore been no direct method of determining the evenness of the burn of wrapper leaf. In the process which we have used for testing wrapper tobacco with regard to these elements of the burn, the area of the leaf consumed, rather than the time elapsing before the glow is extinguished, is measured.

The form of the apparatus used in this method will be understood by reference to the accompanying illustration (fig. 3). The essential feature is the form on which the leaf is wrapped, consisting of a collapsible wooden tube, one end of which fits into a glass tube of the same diameter. This latter is in turn connected with a second glass tube through which is drawn a current of air. The best material for making the wooden form is well-seasoned cherry with a straight grain, but ash has also been found to answer the purpose very well. From the wood selected is made a cylinder 5 inches in length, ¾ inch in diameter at one end, and tapering slightly to the other end (see fig. 4). In the larger end of the cylinder a ⅜-inch hole is bored to a depth of 3¾ inches, and the shell thus formed is separated into six equal segments by sawing to a depth of 3½ inches. The smaller end is cut down for a distance of 1½ inches, so as to fit snugly into the glass tube. The shoulder thus formed should correspond in depth to the thickness of the wall of the glass tube. Near the larger end of the form a groove (*c*) is cut, into which is fitted a rubber band. The plug (*d*) has a diameter such that when inserted in the end of the form the latter is expanded to its original size. The receiver (*a*) for the form is made by drawing out

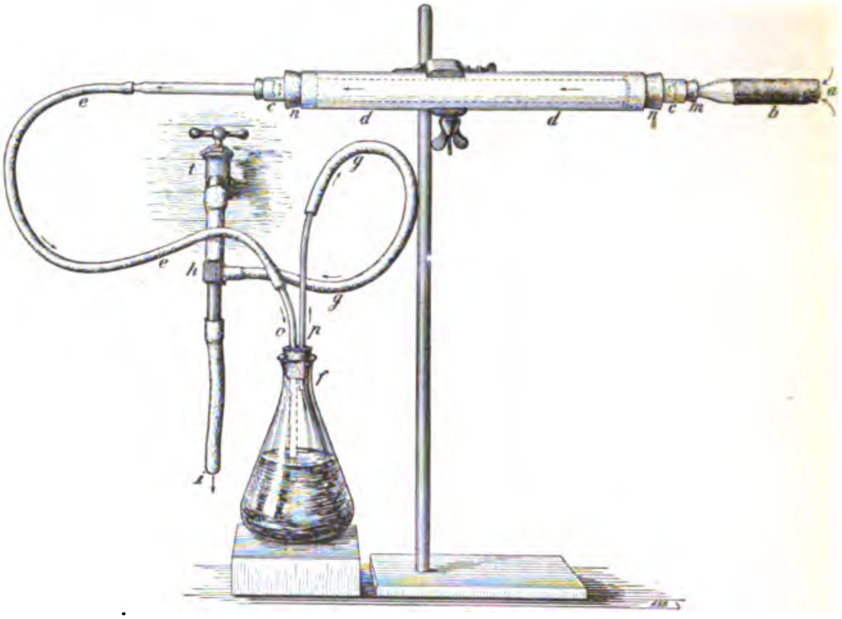


FIG. 3.—Apparatus for testing the burning quality of wrapper tobacco: *a*, entrance of air current; *b*, wrapper to be tested; *c*, *c*, glass tube to which the form bearing the wrapper is attached by means of the cork, *m*; *d*, *d*, large glass tube fitted with corks, *n*, *n*, through which passes *c*, *c*; *f*, flask containing water; *o*, small glass tube dipping beneath the surface of the water in *f*; *p*, short glass tube leading from *f*; *h*, pump by means of which the current of air is secured; *e*, *e* and *g*, *g*, rubber tubing connecting parts of apparatus; *t*, water tap; *i*, outflow of water.

one end of a short piece of thick-walled glass tubing. All of the above dimensions are based on tubing having an internal diameter of 14 mm. (9/16 inch) and an external diameter of 18 mm. (11/16 inch). The small end of the receiver is fitted with a soft cork (*b*), by means of which it is connected with the other portion of the apparatus.

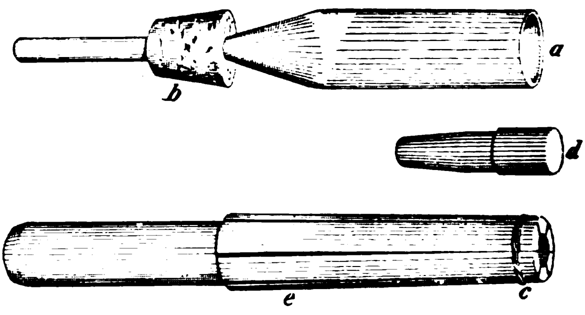


FIG. 4.—Construction of form on which leaf is wrapped for use in apparatus shown in figure 3: *a*, glass tube for receiving the form; *b*, cork by which receiver (*a*) is connected with remainder of apparatus shown in figure 3; *c*, rubber band for collapsing the form; *d*, plug for expanding the form; *e*, form on which leaf is wrapped.

From the leaf to be tested, which should be quite damp, the wrapper is cut into a form quite similar to that used for cigars, and the same rules are observed as regards the cutting of right-handed and left-handed wrappers, etc. Beginning at the outer end the wrapper is rolled quite tightly, first on the form and then on the glass. At the beginning of the process of rolling, the extreme outer corner of the base of the wrapper is attached to the overlapping portion with a bit of cigar paste, and at the end of the operation the tip of the wrapper is attached to the receiver by the same means. A number of samples to be tested are thus wrapped on the forms and set aside until they have dried out properly. The plug in the end of the form is then withdrawn and the rubber band causes the walls of the latter to collapse, so that it can be easily withdrawn from the receiver. This leaves the sample of wrapper securely attached to the glass tube, and in exactly the same form it would have on a cigar. The tube carrying the sample to be tested is connected with the remainder of the apparatus, shown in figure 3, the construction of which will be understood without further explanation. The current of air is furnished by means of an ordinary filter pump, and its rate can be controlled with sufficient accuracy by measuring the flow of water through the pump. The end of the wrapper is ignited with a flat gas flame, and the evenness of the burn and the portion consumed before it ceases to glow are carefully noted. Our method of recording the results is to grade each sample on a scale of ten, both with reference to the evenness of the burn and the fire-holding capacity. Of course, standards in these tests are purely arbitrary, as the results are only intended to be comparative. Under the conditions laid down for the experiment, wrappers having markedly good burning qualities will burn up completely and evenly with only one lighting, and these are given a grade of 10.

For the purpose of comparing the results obtained by this method with those given by the cigar test with reference to the evenness of the burn, a number of leaves were selected from different types of wrapper tobacco. One half of each leaf was used for wrapping a cigar and the second half was wrapped on the form for testing, as has just been described. There was a decided lack of agreement in the results obtained by the two methods when only one type of filler was used in making the cigars. It was found that frequently a wrapper that graded only 5 or 6 on a scale of 10 in what may be called the "form test" would burn quite evenly on the cigar, whereas another wrapper grading as high as 9 in this test would show an uneven burn on the cigar. A good illustration of this point is found in a wrapper which was scored 10, 9, 10, respectively, in three experiments with the form test and gave a fire-holding capacity of 65 seconds by the old method of Nessler. On one type of filler this wrapper gave a very uneven burn, but when smoked on a lighter filler the burn was perfectly satisfactory. These results, then, seem to emphasize the fact that, although the final judgment as to the burning qualities of a wrapper which has shown up well in the preliminary tests must be based on the smoking of the cigar, great care must be exercised to avoid the sources of error in this test which have been previously discussed. The test should not only be repeated with a single type of filler to avoid the effects of any possible unevenness or other imperfections in the manufacture of the cigars, but at least two different types of filler should be used, one of these being heavy and the other light in the sense in which these terms are used here.

TESTING THE BURN OF CIGAR-FILLER TOBACCO.

Testing the burn of a filler is a much simpler problem than is the case with a wrapper. The principal elements of the burn are the evenness and the capacity for holding fire, and the character of the ash is unimportant, except that it should be compact. The evenness of the burn and the fire-holding capacity are best determined by using the cigar test. In the case of filler tobacco the capacity for holding fire thus refers simply to the length of time the cigar will continue to burn after being lighted without being puffed by the smoker. The effects of the binder and wrapper on the burn may be avoided by making the entire cigar from the filler leaf to be tested. Another decided advantage in making the whole cigar from the same tobacco is that the aroma, which is so important in the filler, can also be tested at the same time. In determining the fire-holding capacity it is only necessary to light the cigar and test it at gradually increasing intervals of time to find whether it has ceased to burn. It is, however, desirable to test the fire-holding capacity and the evenness of the burn on separate cigars if sufficient material is at hand for this purpose.

B. P. I.—229.

V.—THE DRUG KNOWN AS PINKROOT.

By W. W. STOCKBERGER, *Expert, Drug-Plant Investigations.*

INTRODUCTION.

The drug known as pinkroot is derived from the underground portions of *Spigelia marilandica* L. (Pl.V), an American herb now found growing most abundantly in the Southern States and occurring locally in the Mississippi Valley and eastward. It came into use in America as a vermifuge about 1723 and because of its valuable properties soon came to occupy an important place in materia medica. Unfortunately, however, conflicting reports on its physiological effects in time established for pinkroot a reputation for uncertain action, and within the last fifty years the use of this drug, once regarded as highly reliable and valuable, has greatly decreased. Since it has seldom been held at high prices the cost has not operated to drive it out of the markets.

The cause of the apparent loss of high efficiency formerly claimed for pinkroot has engaged the attention of students of crude drugs for many years. The demonstration by Dr. R. H. True[a] that an unsuspected substitute had crept into the markets and to a considerable degree replaced the true article has explained in large measure the unfavorable commercial and medical status of pinkroot. The results here outlined of a detailed study of pinkroot and its more important adulterants may serve to aid collectors in discerning the real pinkroot and to assist drug experts in distinguishing the plant from its sophistications in its commercial form.

TRADE VARIETIES OF PINKROOT.

The complex nature of the material put upon the market as pinkroot has long been known to the drug trade, and although the real nature of the spurious article was not understood, its presence was recognized, and various sorts of pinkroot came to be distinguished by definite trade names—e. g., true pinkroot, genuine pinkroot, southern pinkroot, Georgia pinkroot, East Tennessee pinkroot, western pinkroot, and true fiber pinkroot. The visible differences by which these trade varieties are segregated may be utilized in distinguishing the true from the false pinkroot, as it is now definitely known that certain of the trade varieties are wholly composed of worthless substitutes.

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[a] Pharmaceutical Review, 21: 364, 1903.

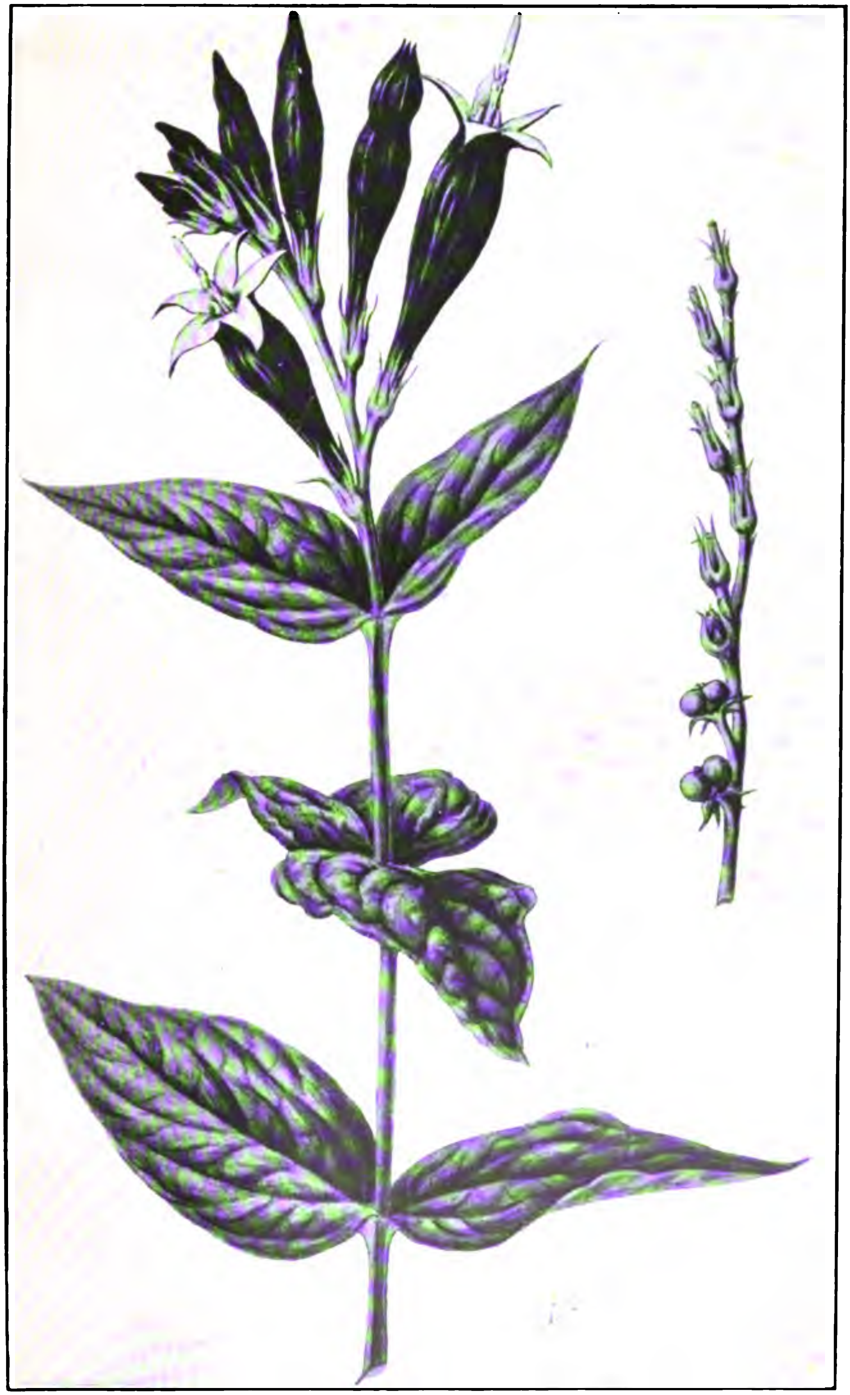
In many cases careless or unscrupulous collectors and dealers have not regarded the distinguishing features of the various sorts of pinkroot, or have been ignorant of them, with the result that very general confusion exists as to the character of the real drug and its adulterants. The authors of some prominent publications on crude drugs have evidently based their observations on trade varieties of pinkroot, as they have illustrated and described one of the most important adulterants as true pinkroot.

IDENTITY OF CHIEF SUBSTITUTES.

East Tennessee pinkroot (*Ruellia ciliosa* Pursh), a member of the plant family Acanthaceae, is the most important adulterant. Observations on the plant structures present in commercial samples of pinkroot convinced Dr. R. H. True, in 1900, that the chief part of this crude drug consisted of a substitute instead of Spigelia and that this substitute was a species of Ruellia. In trying to get plants of pinkroot for cultivation, Doctor True, in 1903, purchased several hundred roots from a dealer in eastern Tennessee. These roots were set out in the testing gardens of the Bureau of Plant Industry at Washington, D. C., and the plants kept under close observation. On developing they were found to differ markedly from Spigelia, and upon flowering were identified as *Ruellia ciliosa* (Pl. VI), a plant which had never appeared in the list of suspected adulterants prior to this time.

The examination of the microscopic structure of this plant recalled at once the figures in some text-books purporting to represent Spigelia and those illustrating an article by Greenish in the Pharmaceutical Journal, 1891, on the structure of *Phlox carolina*, a plant which had long been regarded as an extensive substitute for pinkroot. It was evident that a double confusion existed with regard to Ruellia. On the one hand it was so widely mistaken for Spigelia that its peculiar structures have been regarded as diagnostic of pinkroot, and on the other it was recognized as a substitute, but wrongly regarded as Phlox, a plant lacking many of the striking characteristics of Ruellia.

In order to satisfactorily determine the relation of these substitutions to the true pinkroot, observations have for three years been made upon plants of Spigelia, Ruellia, and Phlox under cultivation at Washington, D. C., and fresh material secured from them has been used in making a comparative study of their structure. The results of this study do not support the view that Phlox is an adulterant of pinkroot, and, moreover, several samples of a substitution supposed to be Phlox have proved, upon examination, to be composed entirely of Ruellia. It is only through long and familiar observation in the



PINKROOT (SPIGELIA MARILANDICA L.).

living condition of all species here concerned that it has been practicable to uncover fully the true relations involved in the drug called pinkroot.

MINOR ADULTERANTS.

Aside from Ruellia, the adulterants of Spigelia may be regarded as impurities, due in the main either to the carelessness of the collector in not sorting out the roots with which the plant was associated in its growth, or perhaps to a lack of familiarity with the plant on the part of young or inexperienced collectors. With Spigelia other roots sometimes occur which have a greater market value than the true pinkroot, and therefore can not be regarded as intentional adulterants. The worthless roots frequently present, however, may have been introduced by the collector with full knowledge that a fraud was being perpetrated. In commercial samples of pinkroot, among other impurities have been observed roots of golden seal (*Hydrastis canadensis* L.), serpentaria (*Aristolochia serpentaria* L.), soapwort (*Saponaria officinalis* L.), wild yam (*Dioscorea villosa* L.), and stoneroot (*Collinsonia canadensis* L.).

METHODS OF DISTINGUISHING PINKROOT FROM ITS SUBSTITUTES.

Once familiar with the true pinkroot it is hard to see how any drug collector could confuse it with the plants so frequently substituted in its place. Spigelia and Ruellia grow over large areas, largely overlapping and in much the same habitat, and have on the whole a certain general resemblance; but they should be readily distinguished by observing any one of their several striking characteristics.

In Ruellia (Pl. VI) the flowers are borne scatteringly along the stem in the axils of the leaves; in Spigelia (Pl. V) they are aggregated at the top of the plant in a one-sided spike. In Ruellia the pale magenta-colored corolla forms a slender tube below, expanded upward into a broad, flaring limb. The anthers and style are not protruded. In Spigelia the corolla forms a rather broad tube, narrowest at the throat, prolonged upward into spreading, narrow, triangular portions. The exterior is brilliant cardinal in color, bright yellow on the inside; the style and anthers are exserted. The leaves of Ruellia are bright green, usually short-petioled or sessile, frequently more or less hairy. In Spigelia they are dark green, glossy, and sessile.

In the crude drug the forms are separated by less evident gross characters. Ruellia, however, has a coarser, harsher root system than Spigelia, and the roots show a tendency to lose the cortical tissues, leaving the naked, woody cylinder exposed. The roots of Spigelia are delicate, fibrous, and usually very numerous. When dry they break and crumble very readily.

The differences in structure between Spigelia and its substitutions as seen under the microscope are usually very marked. This is especially true of Ruellia, the only important adulterant found with Spigelia, since the other plant parts sometimes present are usually recognized by their gross characters. A comparison of figures 5 and 6 will show the most important differences in minute structure. The numerous cystoliths present in Ruellia as a very conspicuous feature are wholly lacking in Spigelia and *Phlox ovata*. The large sclereids of the root of Ruellia are not found in the other two plants, and starch, which is present in Spigelia, is absent in both Ruellia and Phlox.

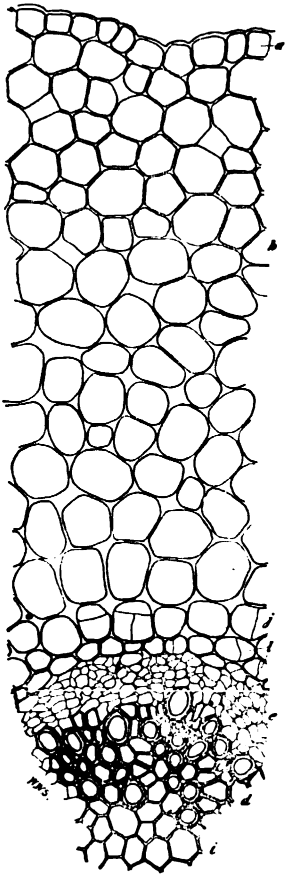


FIG. 5. Cross section of the root of *Spigelia marilandica* L.: *a*, epidermis; *b*, cortex; *d*, xylem; *c*, cambium; *i*, pith; *j*, endodermis; *l*, pericycle. × 180.

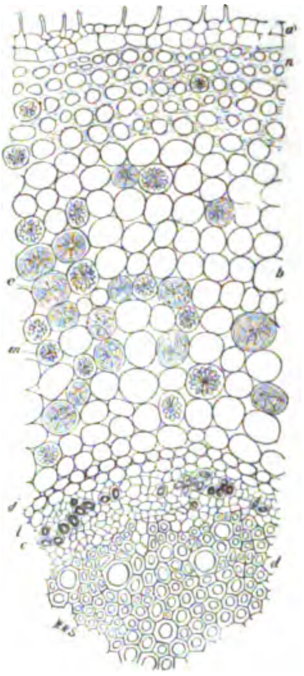
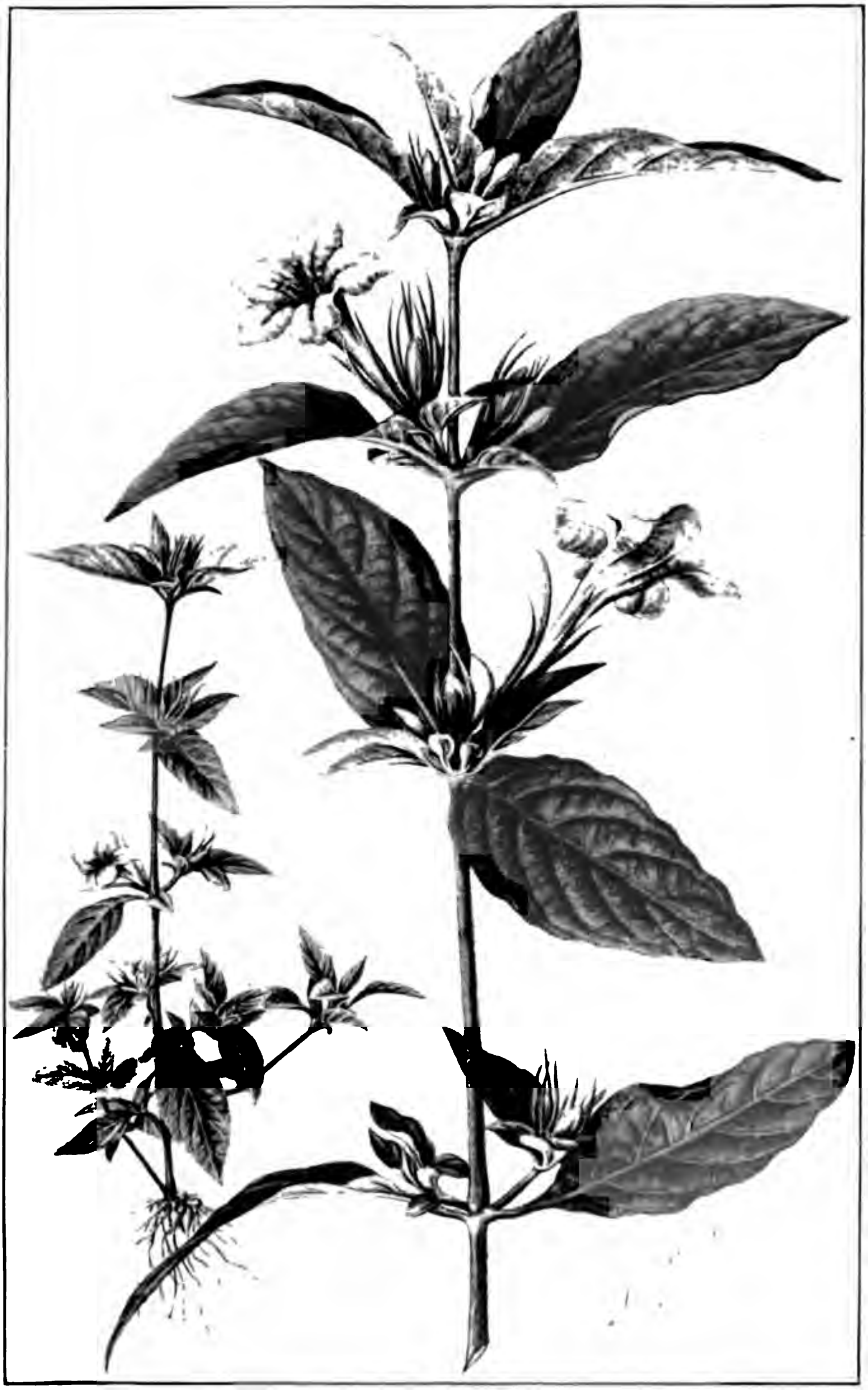


FIG. 6. Cross section of the root of *Ruellia ciliosa* Pursh : *a*, epidermis; *b*, cortex; *c*, bast fibers; *d*, xylem; *j*, endodermis; *l*, pericycle; *m*, cystoliths; *n*, collenchyma; *o*, sclereids. × 150.

In the powdered form Ruellia always reveals its presence by the numerous stone cells and cystoliths, which usually remain intact even in finely powdered material. Powdered samples of the underground portions of the Phlox at hand gave no reaction for starch. The fineness of the starch grain of Spigelia and its lack of striking characters render uncertain its identification among many other plant starches which might be readily introduced in the powdered drug. The starch grains of Spigelia measure about 4 μ, and in powdered pinkroot are associated with parenchyma cells and long light-colored sclerenchyma fibers. The absence of starch from a powder supposedly made of pinkroot suggests at once that the material is not Spigelia. On the other hand, the presence of starch, while indicative of Spigelia, is by no means conclusive proof of its presence.



EAST TENNESSEE PINKROOT (RUELLIA CILIOSA PURSH).

B. P. I.—230.

VI.—ORCHARD GRASS.[a]

By R. A. OAKLEY, *Assistant Agriculturist, Farm Management Investigations.*

INTRODUCTION.

Orchard grass (*Dactylis glomerata* L.) is a well-known standard grass which is grown to some extent in every State in the Union and quite commonly in the region east of the Mississippi River and north of the northern portions of Alabama and Georgia. It attains most importance, however, in Kentucky, southern Indiana, Tennessee, North Carolina, Virginia, West Virginia, and Maryland, and seems quite thoroughly adapted to a variety of soils in these States.

It may be said that the general opinion of farmers in regard to the value of orchard grass either for hay or pasture is quite unfavorable. This unfavorable opinion, which is due somewhat to prejudice, exists to a greater extent in the timothy region than elsewhere, and as the limits of this region are reached and crossed orchard grass is much more highly regarded. The objectionable features of the grass are in general its bunchy habit, coarseness, and the unpalatability of its hay unless cut at the proper state of maturity. These objectionable features are not alone the cause of its unpopularity or the reason why it is not grown more generally. There is no doubt that orchard grass could be grown very successfully throughout the greater portion of the timothy region, but as the demand for any hay except timothy is very limited farmers see little inducement for them to raise it. On account of its maturing well with a number of other very valuable grasses and clovers its popularity may in time increase as the advantages of such mixtures become more generally appreciated.

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[a] In connection with the general plan of the Farm Management work it is contemplated to take up the study of various seed crops. Much interest is now being manifested in better seeds for the farmer. This is especially true of forage-crop seeds, including both grasses and clovers. Mr. Oakley's paper, which is contributed from the Office of Farm Management, conducted under the direction of Prof. W. J. Spillman, is a valuable contribution to the methods followed in growing orchard grass for hay, for pasture, and for seed. Special attention is called to the fact that orchard grass seed as usually grown is for all practical purposes pure. The investigations of this Bureau have shown that considerable quantities of the seed of this grass found in the market contain seed of other and less desirable, cheaper grasses. That the seeds of these cheaper forms have been added for the purpose of adulteration seems evident from the fact that the grasses bearing them are not found in orchard grass fields to any extent worth mentioning.—B. T. GALLOWAY, *Chief of the Bureau of Plant Industry.*

Orchard grass is exceedingly variable and offers a large field for selection and breeding. Its variable characters of most importance are its coarseness, bunchiness, and time of maturing. By consistent selection with special reference to the first two characters valuable strains may in time be developed which will not possess the objectionable features of the common orchard grass now being grown.

METHODS OF CULTURE.

SEEDING.

While there are some methods that are generally employed in the culture of orchard grass, still there is a great difference of opinion even among the most successful growers in any one locality as to the best practices. In the seed-producing section of Kentucky and Indiana it is the common custom to sow the grass in February on fall wheat at the rate of from three pecks to one bushel to the acre. Since the crop in this section is almost entirely harvested for seed, it is not considered desirable to sow more than a bushel. In years past as much as two bushels to the acre were sown, but it is now the general opinion that one bushel is sufficient, and even less is often used. A bushel of orchard grass seed weighs 14 pounds. Orchard grass to give large yields of seed should be reasonably thin, as it produces more abundantly when in this condition. It is usually sown broadcast, as it does not feed out well through a press drill, either by hand or with a wheelbarrow or other type of seeder, and is covered very shallow. Good results are often obtained by not covering the seed, and it is quite a common opinion that too deep covering is the cause of many of the failures to secure a stand.

A method of seeding which is often followed in the section mentioned is to scatter the orchard grass straw from which the seed has been thrashed on ground that has been sown to wheat. This is usually done in February. The straw acts as a mulch in this case and the seed needs no covering. It is very essential that it be scattered evenly and very thin; otherwise the stand will be too thick and unsatisfactory. The greatest objection to this practice is that unless the straw is very clean the meadow is sure to be weedy, and some are of the opinion that since the seed that is left in the straw or blown over with it is mostly of poor quality a field of inferior and unequally maturing grass will be the result.

Orchard grass may be sown successfully after corn by splitting the rows with a disk harrow as soon as the crop is removed. This may be done any time during the month of October, and in February or as soon as the weather is favorable the grass may be sown with a broadcast seeder at the ordinary rate, and the ground being uneven at this time the freezing and thawing which follow will cover the seed sufficiently. Disking seems to give much better results than plowing, since the ground if plowed will not have time to thoroughly settle before the time of seeding. Rolling would doubtless be beneficial after seeding in this manner.

In western Virginia and in Tennessee orchard grass is commonly sown the latter part of September or the first of October with wheat on the ground at the rate of a bushel and a half to two bushels to the acre, the wheat being drilled in at the rate of three to five pecks to the acre and the grass sown either broadcast by hand, with a broadcast seeder, or an attachment to the drill, and covered as shallow as possible.

Orchard grass is often sown with oats, usually in March, on ground that has been previously in wheat and which has been plowed the preceding autumn. A half seeding of oats is usually sown in this case, and gives as a result only a fair crop. The grass, however, makes more pasture the first season as a rule than when sown with a full seeding of either wheat or oats. Early fall seeding with winter oats in sections where the latter can be grown may be depended upon to give good results, but on account of the Hessian fly it is not possible to sow it with wheat much before October.

A crop of hay is not expected the first season, whether the grass is sown in the fall or spring, either alone or with a nurse crop. If sown alone a light cutting may be secured, provided the conditions are favorable, in the latter part of August or September; but in general the grass is pastured and not cut except at the time when the grain which is sown with it is harvested. The following season it makes a crop of either hay or seed, as is desired. There may be some advantage in sowing the grass alone for the extra quantity of forage produced the first year, but whether this and any other advantages that may come from seeding in this way will compensate for the profit accruing from the nurse crop is an undecided question.

MIXTURES WITH RED CLOVER.

Throughout almost the entire region where orchard grass is grown it is quite a common practice to sow red clover with it. This practice is a good one, not only for the value of the red clover in maintaining the soil fertility, but also for the fact that its presence greatly improves the orchard grass either for hay or pasture. In the seed-producing sections red clover is a menace to the seed crop, especially the first and second years. As it is impossible to cut the orchard grass above the clover, the leaves and heads get mixed in with the seed and are difficult to separate from it. Although the presence of the leaves in the orchard grass seed materially decreases its commercial value, the advantage of having the clover in the field more than compensates for this.

In sections where the grass is grown for hay and pasture, red clover is sown at the rate of one bushel to 5 or 7 acres, usually as early in the spring as the weather will permit. It is, however, sometimes sown in the autumn at the same time as the orchard grass, but the seed of the two are not mixed, as they do not feed evenly through the drill or seeder. In cases where clover is sown in the spring on orchard grass that has been sown the fall before, it is either covered lightly by means of a drag harrow or left uncovered. Less clover is sown to the acre in seed-producing sections than where the grass is intended for hay or pasture, the customary quantity being one bushel to 8 or 10 acres. In these sections the first crop is frequently cut for hay on account of its containing so much clover. The second crop usually contains very much less and is cut for seed, as are also the following crops, since the clover at the end of two years usually disappears. Pasturing the field appears to materially increase the longevity of the clover, and it is not uncommon to see meadows that are 6 or 7 years old containing almost as much clover as they did the first year.

Much trouble is now being experienced in securing a catch of red clover throughout the greater part of the region where it is grown. As a result alsike is being substituted in some sections, and where it has been tried thoroughly it is giving good results. This difficulty in growing red clover will doubtless soon become a serious proposition, especially in seed-producing sections, and unless alsike or some similar leguminous crop can be grown it will be only a few years until more barnyard manure or commercial fertilizer will have to be used. At the present time there is very little commercial fertilizer applied to orchard grass, although it is the opinion of some of the more successful growers that an application of about 200 pounds of good fertilizer in the spring, just as the grass begins to grow, would yield profitable results.

MIXTURES WITH OTHER GRASSES.

On account of the bunchy tendency of orchard grass it is often desirable to mix it with other grasses for hay or pasture, and while this has not been practiced as yet to any great extent the results obtained from such mixtures are very promising. Aside from affecting the palatability of the grass, the mixtures have a tendency to increase the yield. Orchard grass matures well with tall meadow oat-grass and meadow fescue, and in some localities in Tennessee a mixture of it with the latter is attracting considerable attention, especially for pasture. Doubtless in time orchard grass will be more generally grown for hay and pasture in mixtures with these or other grasses.

LIFE OF MEADOWS.

Orchard grass is a more hardy and permanent grass than timothy, and as a result remains productive in a meadow under most conditions much longer. In the principal sections where it is grown the average life of a meadow is from five to seven years, although it is a question whether it might not be broken up profitably at the end of four years. Throughout almost its entire region Kentucky bluegrass is its natural enemy and works in around the bunches almost to its ultimate exclusion. Redtop and Canada bluegrass also are present in many sections with the Kentucky bluegrass, and at the end of five or six years these three grasses are greatly in the majority. Pasturing seems to facilitate the growth of the bluegrass, inasmuch as it has a tendency to cause the orchard grass to become more bunchy, and it is also a means of spreading the bluegrass seed. During the last year of its existence it is customary to pasture the orchard grass field, and late in the autumn or early in the winter it is broken up and is planted to corn the following spring. It is well to have the field broken up as early as possible so as to give the sod time to rot sufficiently before planting the corn.

USES AND VALUE.

HAY.

According to chemical analysis orchard grass hay should be equal, if not superior, to timothy, but in real practice it does not seem to be able to successfully compete with the latter. In large cities there is practically no demand for any hay except timothy, and the demand for orchard grass hay is only local and very limited. In the timothy region orchard grass is looked upon very unfavorably, but where timothy can not be grown so successfully its hay is used to a greater extent and is considered of very good quality.

As previously stated, orchard grass should be sown thicker when desired for hay than for seed, 2 bushels of good seed to the acre being usually required, for unless thick it becomes coarse and woody. Its value as hay is increased by the addition of red clover or alsike, and where it has been sown with other grasses, such as tall meadow oat-grass or meadow fescue, its quality seems to be improved by such mixtures. The state of maturity at which the grass makes the best hay is when it is just in bloom. Not only does the quality seem to be better at this time, but the yield is also at the maximum.

In some sections it is considered a good hay for horses, but it is of more value for cattle, and especially for fattening them for the market. As a feed for sheep it is of only fair quality. The value of the hay depends not only on the state of maturity at which it is cut, but also on the bunchiness and coarseness of the grass. These characteristics are influenced largely by the method of culture, and it is often for the reason that farmers do not thoroughly understand growing it that they condemn it as a hay grass. Seeding evenly with the proper quantity of seed and careful pasturing are important factors in securing a good meadow.

PASTURE.

For pasture, orchard grass gives best results in mixtures with other grasses and clovers, and is of special importance from the fact that it can be grazed early and late in the season. It is quite a valuable grass if for no other reason than this. It also stands grazing fairly well. It must, however, be closely pastured; otherwise it will become too coarse and woody, and stock will not eat it. Stock do not relish the mature grass, and invariably lose flesh when turned on a field in this condition. To secure best results from pastures, they should be mowed some time during June to keep down the weeds, and again later as needed. In this way they are kept clean and more productive. Bluegrass and white clover are usually very prominent in most orchard grass pastures and are valuable additions, as they grow between the bunches of the orchard grass, thus increasing the yield. The white clover is also of value in maintaining soil fertility.

SEED.

Orchard grass seed is produced to some extent throughout the entire region in which it is grown. There is quite a quantity raised in western Virginia, but the greatest seed-producing area is in the vicinity of Louisville, including Jefferson, Oldham, and Shelby counties, Ky., Clark County, Ind., and some of the counties adjoining those in both States mentioned. Just why there is more seed produced in this section than elsewhere is not definitely known. Some are of the opinion that it is because orchard grass seeds more readily there, which may be true. However, the cultural methods employed by farmers in this section may have something to do with the success attained in raising it. In Oldham County, Ky., the average production is about 55,000 bushels, which represents practically 5,000 acres, as the yield is about 10 to 12 bushels to the acre. The growing of seed in the section referred to is a profitable industry, and there are many farmers who engage in it quite extensively with uniform success. It is said to be a more profitable crop than wheat, and when the harvest of the two conflict orchard grass is given the most attention. The average price of seed for the last ten years has been about $1.25 a bushel. The seed alone does not represent the entire return from the field, for after it is harvested the meadows afford hay or pasture, or both, from which a considerable profit accrues. Orchard grass seed is the controlling crop in this section, and the cropping system is planned to accommodate it.

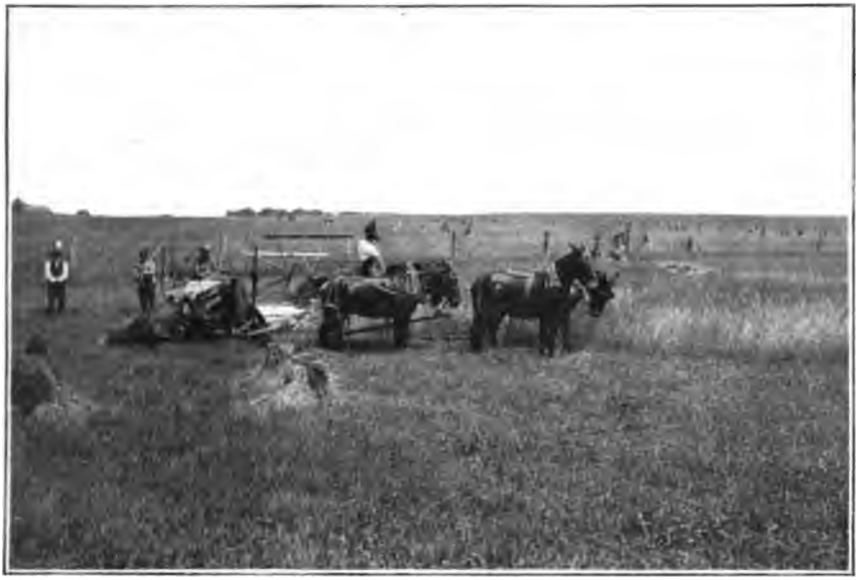

FIG. 1.—HARVESTING ORCHARD GRASS FOR SEED.

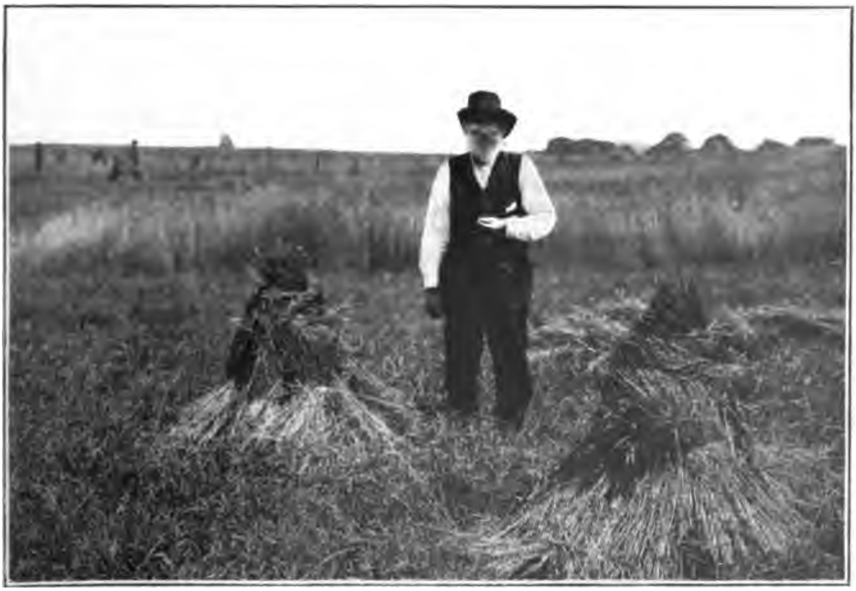

FIG. 2.—METHOD OF SHOCKING ORCHARD GRASS; SHOCKS SHOWING BANDS AT TOP.

HARVESTING THE SEED CROP.

The methods used in harvesting orchard grass seed are practically the same throughout the whole country. In general, harvest begins about June 15 and lasts about ten days, though when there is a large acreage it is often necessary to begin earlier than this, in order to finish before the seed becomes too ripe. An inferior quality results from cutting the seed before it is sufficiently mature, and this seed is quite readily detected by its light-green color. When properly-matured the seed is straw colored, and not at all green. A common test to determine whether the seed is at the proper stage for cutting is to beat the heads in the palm of the hand, and if quite a quantity shatters off it is considered ready to cut. To one unfamiliar with the crop it would seem that the waste from shattering would be great.

Orchard grass is harvested with an ordinary grain binder (Pl. VII, fig. 1), making as small bundles as possible, in order that they may cure readily. The bundles are placed usually three in a shock and the shocks tied at the top with two bands of straw, one about 8 inches below the other (Pl. VII, fig. 2). They are bound in this way so as to make them more stable and to prevent the seed from shattering. The shocks are made small to facilitate handling at the time of thrashing, and so that they may be easily tied at the top with the straw bands. They are left standing from two to four weeks, or until they have had time to cure thoroughly, and are thrashed without stacking. On an average it takes about 5 pounds of twine for 100 bushels of seed. The crop is of such importance that the fence corners and other places that can not be reached with the binder are cut with the cradle and bound into bundles by hand.

When the grass is sufficiently tall it is cut from 12 to 14 inches high, to avoid the low-growing weeds, such as plantain and sorrel, and also clover and bluegrass. Another advantage in high cutting is that it leaves more of the undergrowth to be utilized later for hay or pasture.

THRASHING.

The common grain separator is used for thrashing with the ordinary cylinder and concaves, but with special riddles and with nearly all the wind shut off to prevent too much of the seed from being blown over. In hauling the shocks to the machine, racks with tight beds or with tarpaulins spread over the bottom are used to catch the seed that shatters off, which is usually considerable. This is always heavy seed, and is worth saving. Since the shocks are small, a whole one may be thrown on the rack at one forkful without breaking the bands. This reduces shattering to a minimum. Unless the grass is very weedy the thrashing machine cleans the seed sufficiently for the market, but most of the larger growers have hand fanning mills, which are used when necessary. Seeds like those of redtop are easily blown out, but it is harder to dispose of the bluegrass and some of the weed seeds, such as plantain and whitetop. From the machine the seed is put into 8-bushel bags for shipping. Thrashing costs on an average 8 cents per bushel, with the customary crew furnished.

HANDLING THE AFTERGROWTH.

In cases where orchard grass is cut for seed there is a great difference of opinion as to how the aftergrowth should be handled. It is generally considered that pasturing is not in the least detrimental but is even beneficial. Whether the aftergrowth should be cut for hay is an undecided question. It is a common practice, however, to cut it, due to the fact that it is depended upon largely for hay, since timothy and other hay grasses are not grown to any great extent. After the grass is cut for seed, especially when it is cut sufficiently high, there is always considerable green undergrowth. This continues to grow, and during the latter part of August or about the first of September is at the proper stage to cut for hay. If there is clover present in the aftergrowth it makes a very fair quality of hay and yields from one-half to one ton to the acre. The quality of this hay is not so good as that of the hay made from the first cutting.

While it is a general practice to cut the aftermath during the latter part of August or September, there are some who prefer to cut it as soon as the shocks are removed from the field, as it is believed to be better for the following seed crop if it is cut then. It is the opinion of some that the aftermath should be cut in any event, and consequently if it is not desired for hay it is cut and left on the ground. Others are of the opinion that if it is cut at all it materially injures the next year's crop, especially so if used for hay, as the two cuttings remove a large amount of plant food from the soil without much return.

Judicious pasturing, to say the least, is not detrimental to the field, and in all probability is more or less beneficial. The aftergrowth, which comes on after the seed crop is removed, furnishes grazing until it is covered with snow, and in the more southern sections where the grass is grown lasts nearly the entire winter. Sheep can be very profitably pastured on this aftergrowth, and in many cases almost as much money is made from the pasture that it affords the sheep as from the seed crop, on account of the length of time which it will furnish grazing. At present prices sheep are equally as profitable as cattle, if not more so, and can be pastured on orchard grass to much better advantage.

VALUE OF THE STRAW.

There is much difference of opinion regarding the value as a feed for stock of orchard grass straw from which the seed has been thrashed. Some state that it is of almost as much value as the hay, but in general it is thought to be about equal to wheat straw. Its value depends largely on three factors: The state of maturity at the time of cutting; the amount of aftergrowth, including red clover, contained in it, and the success with which it is cured. If the grass is cut before the seed is sufficiently mature to harvest, the straw will be of more value for feed than when it is cut at the proper stage. The undergrowth which is present probably furnishes as much feed as the straw itself, if not more, especially when it contains clover.

It is a common practice to cut the grass as high as possible to avoid the weeds and clover, but if it is short there is necessarily a great deal of undergrowth cut with it. If the grass has not received too much rain while in the shock and is stacked properly or put into a barn or shed at the time of thrashing, the straw will be of much more value than if carelessly handled. In general, there is little attention paid to the stacking of the straw, and it is commonly left in piles just as they are made by the machine. When utilized for forage it is fed to horses or cattle, usually the latter, but is of very little value for sheep. Aside from its value as a feed, straw may be used for seeding meadows, as previously described. It should never be used for this purpose, however, unless thoroughly free from weeds.

WEEDS IN ORCHARD GRASS SEED FIELDS.

The weeds which are most troublesome in orchard grass fields, especially in sections where seed is produced, are whitetop (*Erigeron annuus*), red sorrel (*Rumex acetosella*), oxeye daisy (*Chrysanthemum leucanthemum*), milfoil (*Achillea millefolium*), and the plantains (*Plantago lanceolata* and *P. aristata*). Most growers pay much attention to keeping these weeds out of their fields and go to considerable expense for labor to mow them or cut them out with a hoe just before harvest. A method which is now quite commonly used and which is most effective and practicable is to pasture the fields with sheep. This is an excellent practice and it is comparatively easy to distinguish at harvest time between fields that have been pastured in this way and those that have not by the absence of weeds in the former. Such good results have been obtained by pasturing sheep on the grass to keep down the weeds that farmers are raising more sheep than formerly and are growing cleaner seed. It is a common practice to turn the sheep on in the spring as soon as the grass begins to grow and allow them to remain until the early part of May. As the grass advances toward maturity the sheep eat very little of it, but graze mostly upon the weeds and undergrowth, and especially on the whitetop, which is one of the worst weeds present, if not the worst. They do little damage to the field when it is dry, and in wet weather they are kept off, as they drag down too much of the grass. Although it is the custom to turn the sheep out of the fields in the early part of May, some of the most successful growers leave them in until nearly harvest time. It is not uncommon to see sheep in fields that are ready to harvest. When it is possible to do so the fields should be pastured late, as this practice is more effective in keeping down the weeds, since it takes them but a short time to make sufficient growth to interfere with the cleaning of the seed. Cattle are sometimes pastured on fields that are intended for seed, but they tramp down too much of the grass and are not as satisfactory for this purpose as sheep.

OTHER GRASSES IN FIELDS INTENDED FOR SEED.

Much has recently been said regarding the presence of seeds of other grasses in orchard grass seed. Those which appear to be the most common are meadow fescue (*Festuca pratensis*) and the rye-grasses (*Lolium perenne* and *Lolium italicum*). The seed of these grasses is much heavier, but it resembles orchard grass seed to such an extent that its presence is not readily detected. Meadow fescue and rye-grass have very much the same appearance, but there is no difficulty in distinguishing them from orchard grass, as their seed habits and general habits of growth are different. If these grasses were present in considerable quantities in the orchard grass fields in Kentucky, Indiana, and western Virginia, where practically our entire supply of seed is produced, the presence of their seed in orchard grass seed could be readily accounted for. The orchard grass fields in these sections, however, are almost entirely free from other grasses, and only in a very few cases are there any others present, with the exception of some Kentucky bluegrass (*Poa pratensis*) and Canada bluegrass (*Poa compressa*) and a little cheat (*Bromus secalinus*) and redtop (*Agrostis alba*). Bluegrass and redtop, especially the former, come in naturally in the older fields, and cheat is present practically only the first year, due to its having been in the wheat which just preceded the grass crop. The quantity of meadow fescue and rye-grasses in these fields is insignificant, and there are only a very few cases where these grasses are present at all. The total percentage of other grasses in orchard grass throughout the whole seed-producing section is so small as to be hardly worthy of consideration, and statements made to the effect that the presence of their seed in orchard grass seed is due to the fact that they are grown with the orchard grass and can not be separated from it are entirely without foundation. Farmers in general are extremely careful to keep their orchard grass fields free from other grasses, for the reason that their seeds are readily detected by buyers and as a consequence the seed invariably sells at a lower price. It is a comparatively easy matter for seed growers to have pure seed for their own sowing, and there would be absolutely no advantage to them in growing meadow fescue, rye-grasses, and other grasses with orchard grass.

SUMMARY.

Orchard grass is of considerable value for early and late pasture, and in the southern part of the region where it is grown can be pastured nearly the entire year. When used for pasture, bluegrass and white clover are commonly grown with it.

Orchard grass hay is of value, especially when it contains red clover, and can be fed to horses successfully. It is a good forage for cattle that are being fattened for market.

When grown for seed, orchard grass is a profitable crop, as it yields on an average 10 to 12 bushels to the acre and sells for $1.25 a bushel. Aside from securing a crop of seed, the aftergrowth may be either pastured or cut for hay. This aftergrowth makes a very fair quality of hay, and when cut during the latter part of August or September gives a yield of from one-half to one ton to the acre.

Although not previously stated, orchard grass is quite valuable for binding soils, and on rough land that washes badly it can be used for this purpose effectively.

Orchard grass may be seeded either in the autumn or spring with about equally good results. Spring seeding, however, seems to be the most common practice. In most cases it is sown broadcast on fall wheat on fields that have been in wheat the previous year. One bushel of seed is a sufficient quantity when the grass is to be grown for seed. When grown for hay or pasture, more than this should be used. A good catch may be obtained by scattering the straw evenly and thinly on fall wheat in early spring.

Red clover can be profitably sown with orchard grass at the rate of 1 bushel to 5 or 7 acres. Mixtures of orchard grass with other grasses, especially with tall meadow oat-grass and meadow fescue, are giving good results for hay and pasture in places where they are being tried.

The average life of an orchard grass meadow is from five to seven years, after which it is plowed up, usually late in the fall, and put into corn.

Orchard grass is harvested for seed from about June 15 to June 25. It is cut with an ordinary grain binder and bound into small bundles, requiring about 5 pounds of twine to 100 bushels of seed. The bundles are put three in a shock and bound at the top with a band of grass to make them more stable and to prevent the seed from shattering. Thrashing is done from the shock after the grass has stood in the field from two to four weeks, with an ordinary separator, using special riddles.

Sheep are pastured on orchard grass in the spring to keep down the weeds. They are sometimes allowed to remain in the field until nearly time to harvest. This practice is very effective in keeping clean the fields that are grown for seed.

The percentage of meadow fescue, rye-grasses, and other grasses in orchard grass fields that are grown for seed is so small as not to be worthy of consideration.

VII.—THE EFFECT OF COPPER UPON WATER BACTERIA.[a]

By Karl F. Kellerman, *Physiologist in Charge of Soil Bacteriology and Water Purification Investigations*, and T. D. Beckwith, *Scientific Assistant*.

INTRODUCTION.

Of the many methods of chemical treatment for water purification, the copper method has recently received the most attention. The use of this metal, or its salts, was urged primarily[b] for the eradication or control of polluting algæ, though popular attention has been directed more particularly to the various results obtained in destroying the typhoid bacillus.

The discrepancies between laboratory results of some of the investigators of this phase of the subject have deterred many engineers and sanitarians from conducting important tests of the value of copper under emergency or epidemic conditions. These discrepancies are perhaps in some cases due to reasons which are taken up later in this bulletin, and in some cases to the lack of comprehension of the essential difference between treatment of drinking water which contains relatively little albuminoid matter[c] and treatment of bouillons or emulsions.[d]

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[a] The copper method for controlling algal pollution can no longer be considered in an experimental stage. The accumulation of results of treatments constantly made under the direct supervision of officials of the Department of Agriculture and the numerous results reported to this Department by independent experimenters render further discussion of this question superfluous. The caution should be reiterated, however, that no rule for determining the amount of copper sulfate to be added can be given, and each body of water must be treated in the light of its special conditions. This caution is eminently applicable to copper treatment of a water supply for bactericidal purposes, and, as Mr. Kellerman and Mr. Beckwith have shown in their recent work, the problem of using dilute solutions of copper for destroying *Bacillus coli* and *Bacillus typhi* in water is a rather complicated one. Pertinent conditions must be understood thoroughly before an application of copper can be safely advised, and whether an emergency treatment of an unfiltered and contaminated water, or a continuous treatment of a filtered water supply, or a treatment of a sewage effluent is contemplated the work should be supervised by an expert.—A. F. Woods, *Pathologist and Physiologist, Acting Chief of Bureau.*

[b] Buls. 64 and 76, Bureau of Plant Industry, U. S. Dept. of Agriculture.

[c] See also Buls. 64 and 76, Bureau of Plant Industry, U. S. Dept. of Agriculture.

[d] A case in point is a paper by Dr. J. B. Thomas, Report on the Action of Various Substances on Pure Cultures of the Amœba Dysenteriæ. (Amer. Jour. Med. Sci., vol. 131, No. 1, Jan., 1906, p. 116.) "Uniform suspensions of the amœba were made by pouring 4 cc. of distilled sterile water over the surface of a 48-hour slant agar culture of the amœba and cholera spirillum, scraping off the surface growth and mixing with the matter by means of a platinum wire, and pouring the resultant emulsion into a sterile test tube; 4 cc. of the antiseptic solution (in double strength)

In spite of the fact that the field results of several experimenters[a] have apparently established the point that copper sulfate will not destroy ordinary water bacteria at concentrations fatal to the colon and typhoid bacilli, the somewhat fanciful objection has been suggested to chemical treatment of any kind, and to copper treatment in particular, that bacteria desirable for oxidation of organic matter and other beneficial changes in a water supply might be injured equally with the typhoid bacteria, and thus a treated water be more potentially dangerous than an untreated water known to contain typhoid organisms; in other words, that many bacteria which could be of decided benefit in a slightly polluted water supply might be eradicated by copper treatment and that in this way the fractional sterilization of a reservoir by copper might pave the way for a more dangerous contamination.

Investigations of these and other points have been undertaken, and it is believed that valuable data have been obtained, applicable to copper treatment for algæ, to emergency treatment for typhoid, and to copper treatment in connection with filtration. The copper treatment of sewage may be influenced by the same conditions that bear upon the effect of copper treatment of water. For the present, however, the investigations of Johnson,[b] at the Columbus, Ohio, sewage testing station may be considered sufficiently accurate for practical purposes.

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to be tested was then added to the 4 cc. emulsion of amœbæ, thus making a fairly uniform emulsion of 8 cc. of liquid to one 48-hour slant culture, the mixture containing a definite amount of the chemical to be tested. * * * It would appear from the above results that it would be disastrous to rely on the action of copper containers to purify water infected with amœbæ or cholera."

[a] Caird. Copper Sulphate Results. Paper read at meeting of American Water Works Association, Boston, Mass., July 10–14, 1906.

Jackson. Journal New England Water Works Association, vol. 19, 1905, pp. 563–568.

Hollis. Journal New England Water Works Association, vol. 19, 1905, pp. 571–572.

Stokes and Thomas. The Effect of Copper Sulphate upon the Bacteriological and Chemical Constituents of Large Bodies of Water. Public Health Papers and Reports, American Public Health Association, vol. 31, part 1, 1905, pp. 75–90.

[b] The Copper Treatment of Sewage Effluents. Report on Sewage Purification at Columbus, Ohio, 1905.

"Available data indicate that the removal by either process of applied pathogenic and nonpathogenic bacteria is in fairly direct proportion, generally speaking, although, of course, saprophytic bacteria may multiply within the tanks or filters, so as to obscure the true removal. Under some conditions it might be advantageous to employ a germicide, such as sulphate of copper, as a final treatment for sewage effluents of doubtful bacterial purity." (P. 471.)

"Independent of the question of complete sterilization as touched upon * * * it may be that there is a field of usefulness in some places for copper sulphate or other germicidal chemical in the treatment of coarse-grain filter effluents, in order to bring them from a bacterial or hygienic standpoint to a degree of purity strictly comparable with that of the effluent of ordinary intermittent sand filters." (P. 479.)

RESISTANCE OF VARIOUS BACTERIA.

Several species of bacteria occurring commonly in Potomac River water have been isolated, and comparative tests have been carried on with these bacteria and with the colon bacillus. An examination of the tables showing the exact results of these tests indicates clearly that no danger to most of the common saprophytic bacteria can be expected from using concentrations of copper sufficiently strong to destroy *Bacillus coli.* To allow as little variation as possible in the different tests all experiments were carried out in triple-distilled water. This will probably explain the sensitiveness of most of the bacteria to copper solutions, for, as Gildersleeve[a] has stated, "The resistance of bacteria washed in distilled water is lessened, due in all probability to the fact that some of the slimy substance which surrounds the bacterial cell and protects it to some extent from the action of detrimental agencies is removed." For purposes of comparison the table showing the action of copper sulfate on various bacteria in tap water, published by Gildersleeve,[b] is reproduced below.

Organism.	Dilution.	Average number to the cubic centimeter in control.	Percentage destroyed in hours specified.												
			1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	24.
B. typhosus	1: 250,000	110,000	100	....	....	....	....	....	....	....	....	....	....	....	....
	1: 500,000	100,000	99	100	....	....	....	....	....	....	....	....	....	....	....
	1:1,000,000	140,000	78	100	....	....	....	....	....	....	....	....	....	....	....
	1:1,500,000	120,000	50	85	99	100	....	....	....	....	....	....	....	....	....
	1:2,000,000	130,000	4	7	55	80	82	87	87	93	98	100	....	....	....
B. coli communis	1: 250,000	105,000	100	....	....	....	....	....	....	....	....	....	....	....	....
	1: 500,000	120,000	99	100	....	....	....	....	....	....	....	....	....	....	....
	1:1,000,000	99,000	80	99	100	....	....	....	....	....	....	....	....	....	....
	1:1,500,000	150,000	87	95	99	100	....	....	....	....	....	....	....	....	....
	1:2,000,000	110,000	8	10	14	27	50	85	90	92	93	93	95	98	100
B. dysenteriæ	1: 250,000	11,500	95	100	....	....	....	....	....	....	....	....	....	....	....
	1: 500,000	120,000	40	95	97	100	....	....	....	....	....	....	....	....	....
	1:1,000,000	72,000	31	50	62	85	99	99+	100	....	....	....	....	....	....
	1:1,500,000	12,400	20	30	40	42	60	70	75	81	85	87	90	91	100
	1:2,000,000	13,600	20	20	25	30	30	45	60	62	62	68	71	75	98
B. cloacæ	1: 250,000	92,000	90	99	100	....	....	....	....	....	....	....	....	....	....
	1: 500,000	86,000	68	90	99	100	....	....	....	....	....	....	....	....	....
	1:1,000,000	101,000	33	85	89	96	96	99	100	....	....	....	....	....	....
	1:1,500,000	89,000	5	10	30	40	70	85	95	98	98	99	100	....	....
	1:2,000,000	94,500	3	10	31	40	80	83	85	88	91	91	93	97	100
B. proteus vulgaris	1: 250,000	115,000	93	100	....	....	....	....	....	....	....	....	....	....	....
	1: 500,000	106,000	65	92	98	100	....	....	....	....	....	....	....	....	....
	1:1,000,000	111,000	28	51	82	90	95	98	100	....	....	....	....	....	....
	1:1,500,000	99,000	10	18	27	42	69	90	93	98	99+	100	....	....	....
	1:2,000,000	118,000	0	12	22	36	51	65	78	80	85	88	92	95	100
B. prodigiosus	1: 250,000	102,000	95	99	99	99+	100	....	....	....	....	....	....	....	....
	1: 500,000	109,900	15	26	80	95	97	99	99+	100	....	....	....	....	....
	1:1,000,000	110,000	9	11	16	33	33	45	47	61	63	69	....	....	93
	1:1,500,000	107,000	4	12	17	30	38	46	46	48	51	52	60	61	92
	1:2,000,000	98,000	0	1	8	8	10	11	15	30	38	41	43	50	88
Staphylococcus pyogenes aureus	1: 250,000	92,000	99	100	....	....	....	....	....	....	....	....	....	....	....
	1: 500,000	88,000	50	70	90	100	....	....	....	....	....	....	....	....	....
	1:1,000,000	86,000	15	30	30	70	78	85	97	99	99	100	....	....	....
	1:1,500,000	100,000	8	22	28	96	58	69	85	93	95	99	100	....	....
	1:2,000,000	95,000	1	8	10	30	50	64	79	82	85	98	99	99+	100

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[a] Studies on the Bactericidal Action of Copper on Organisms in Water. American Journal of Medical Science, vol. 129, 1905, p. 754.

[b] Op. cit., p. 759.

The figures in this table are rather surprising in connection with the statement that "very little difference was found between distilled and filtered water used in the laboratory." The similarity here of the action of copper in distilled and filtered tap water, contrasted with the marked difference in the action of distilled and filtered tap water in Washington, emphasizes a point previously mentioned,[a] that the water itself deserves as careful a study as do the organisms contained therein. This is suggested again in Phelps's[b] report showing that with either hard or turbid waters the germicidal efficiency of metallic copper is much lessened. Again, in view of the high toxicity that investigators have reported with copper in Philadelphia tap water, it seems necessary to assume that this water either is peculiarly favorable to maintaining the metal in a toxic state, or, what seems equally probable, for rendering the bacteria unusually sensitive.

The results of our own experiments are given in the following tables. All the experiments, unless otherwise indicated, were conducted in Weber resistance glass test tubes, each containing 10 c. c. of water triple distilled from glass, portions of which had been treated previously with the desired amount of copper sulfate. All tubes were inoculated with a 2 mm. loop of the proper organism. The temperature during each experiment varied from 18° to 22° C.

TABLE I.—*Effect of copper sulfate upon Bacillus mycoides.*

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—					
		10,000 parts of water.	25,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	105	90	590	310	70	250	90
6 hours	80	1	20	80	15	35	15
24 hours	185	10	130	110	40	20	50

TABLE II.—*Effect of copper sulfate upon Bacillus megatherium.*

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—					
		10,000 parts of water.	25,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	70	55	45	30	90	15	50
2 hours	50	10	25	30	40	0	20
6 hours	40	15	20	10	40	1	15
24 hours	200	10	15	5	10	2	10

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[a] Bul. 76, Bureau of Plant Industry, U. S. Dept. of Agriculture, p. 12; and Kellerman, Journal New England Water Works Association, vol. 19, 1905, p. 536.

[b] Journal New England Water Works Association, vol. 19, 1905, pp. 537–539.

TABLE III.—*Effect of copper sulfate upon Bacillus mesentericus.*

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to— 10,000 parts of water.	25,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	300	380	400	520	280	440	470
2 hours	280	170	310	440	260	340	360
6 hours	430	10	290	320	250	310	390
24 hours	1,350	0	0	530	3	4	30

TABLE IV.—*Effect of copper sulfate upon Bacillus mesentericus fuscus.*

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to— 10,000 parts of water.	25,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	30	40	25	25	50	20	30
2 hours	0	5	50	10	3	0	1
6 hours	2	1	30	5	5	2	1
24 hours	70	110	70	45	0	10	80

TABLE V.—*Effect of copper sulfate upon Streptococcus pyogenes.*

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to— 10,000 parts of water.	25,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	180	875	875	300	250	90	180
2 hours	210	0	0	290	180	180	180
6 hours	140	0	0	280	230	240	160
24 hours	35	0	0	390	150	10	20

TABLE VI.—*Effect of copper sulfate upon Bacillus subtilis.*

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to— 10,000 parts of water.	25,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	310	80	20	130	85	100	30
2 hours	220	1	3	30	120	70	10
6 hours	330	1	1	25	85	50	2
24 hours	2,800	1	0	30	70	65	0

TABLE VII.—*Effect of copper sulfate upon Bacillus prodigiosus.*

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to— 10,000 parts of water.	25,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	350	450	400	1,050	22,000	2,000	1,800
2 hours	750	65	180	1,700	1,350	2,050	1,550
6 hours	1,250	1	0	2	0	550	200
24 hours	925	0	0	0	0	0	0

TABLE VIII.—*Effect of copper sulfate upon Bacillus liquifaciens phosphorescens.*

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—					
		10,000 parts of water.	25,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	16,500	3,400	2,400	16,000	4,500	10,400	13,000
2 hours	15,800	0	1	0	5	2,900	7,300
6 hours	23,000	0	0	0	0	640	7,000
24 hours	36,000	0	0	0	0	60	5,300

TABLE IX.—*Effect of copper sulfate upon pink yeast.*

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—					
		10,000 parts of water.	25,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	310	550	100	110	100	220	108
2 hours	150	5	1	0	1	65	85
6 hours	70	0	0	0	1	3	50
24 hours	90	0	0	0	0	1	30

TABLE X.—*Effect of copper sulfate upon Bacillus coli.*

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—					
		100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.	2,000,000 parts of water.	3,000,000 parts of water.	4,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	2,650	2,300	3,100	2,700	2,250	1,800	1,770
2 hours	2,350	1,650	2,650	2,000	1,650	1,850	1,850
6 hours	2,300	0	0	95	210	850	1,070
24 hours	6,300	0	0	0	0	0	65

TABLE XI.—*Effect of copper sulfate upon sulfur yellow bacillus.*

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—					
		10,000 parts of water.	25,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	2,800	40	3,100	2,800	4,100	860	1,300
2 hours	2,000	0	0	0	280	1	2
6 hours	1,500	0	0	0	0	0	0
24 hours	24,000	0	0	0	0	0	0

TABLE XII.—*Effect of copper sulfate upon Pseudomonas radicicola (soy).*

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—					
		10,000 parts of water.	25,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	1,900	520	1,300	2,800	650	520	3,100
2 hours	1,800	0	0	45	0	25	1,100
6 hours	2,100	0	0	0	0	0	30
24 hours	18,000	0	0	0	0	0	0

TABLE XIII.—*Effect of copper sulfate upon Bacillus sublanatus.*

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—					
		10,000 parts of water.	25,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	12,500	780	2,700	2,100	1,100	2,100	1,500
2 hours	12,000	0	0	0	0	35	190
6 hours	12,500	0	0	0	0	0	80
24 hours	40,000	0	0	0	1	0	0

TABLE XIV.—*Effect of copper sulfate upon Micrococcus radians.*

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—					
		10,000 parts of water.	25,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	1,200	2,700	10,500	1,700	3,800	2,500	2,800
2 hours	1,200	1	0	1	20	85	10
6 hours	1,400	0	0	0	0	0	1
24 hours	1,900	0	0	0	0	0	0

TABLE XV.—*Effect of copper sulfate upon Pseudomonas radicicola (alfalfa).*

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—					
		10,000 parts of water.	25,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	270	300	330	425	3,700	700	290
2 hours	210	0	0	0	0	0	0
6 hours	220	0	0	0	0	0	0
24 hours	1,175	0	0	0	0	0	0

TABLE XVI.—*Effect of copper sulfate upon Bacillus violaceus laurentius.*

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—					
		10,000 parts of water.	25,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	7,200	120	480	740	470	210	520
2 hours	5,300	0	0	0	0	1	25
6 hours	6,800	0	0	0	0	0	0
24 hours	40,000	0	0	0	0	0	0

TABLE XVII.—*Effect of copper sulfate upon Pseudomonas amethystina.*

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—					
		10,000 parts of water.	25,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	140	540	90	70	580	670	660
2 hours	190	0	0	1	3	3	15
6 hours	240	0	0	0	0	1	1
24 hours	....	0	0	0	0	0	0

TABLE XVIII.—*Effect of copper sulfate upon Bacillus caudatus.*

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—				
		10,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	875	60	680	2,100	15	70
2 hours	350	0	0	1	0	0
6 hours	400	0	0	1	0	0
24 hours	9,000	0	0	0	0	0

TABLE XIX.—*Effect of copper sulfate upon Bacillus rubrum.*

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—					
		10,000 parts of water.	25,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	175	10	30	225	90	210	135
2 hours	195	0	0	90	0	0	0
6 hours	50	0	0	5	0	0	0
24 hours	1,050	0	0	5	0	0	0

EFFECT OF CARBON DIOXID ON VIABILITY OF BACILLUS COLI AND BACILLUS TYPHI.

A careful study of the gas content of both tap and triple distilled water has shown that for the typhoid and colon bacilli the presence of carbon dioxid in the water is associated with heightened resistance to toxic agents, such as solutions of copper salts, precipitated copper salts, and copper metal. This is the more strange when one considers that the presence of carbon dioxid. in water causes the copper to remain in solution, and in case of insoluble copper, either precipitated or metallic, the carbon dioxid serves to bring a considerable amount of copper into solution. It should be noted, however, that water heavily saturated with carbon dioxid is toxic to *Bacillus coli* and *Bacillus typhi.*

A series of experiments designed to test the effect of carbon dioxid on *Bacillus coli*, the various conditions of triple distilled water with and without copper, triple-distilled water plus calcium carbonate with and without copper, and tap water with and without copper are tabulated below.

TABLE XX.—*Toxicity of copper sulfate to Bacillus coli in the absence of carbon dioxid.*[1]

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—				
		10 000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	6,800	1,400	2,300	2,200	900	3,500
2 hours	5,100	0	0	0	2	80

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[1] Experiment conducted in Weber resistance glass test tubes each containing 10 c. c. of water triple distilled from glass, portions of which had been treated previously with the desired amount of copper sulfate. All tubes inoculated with a 2 mm. loop of culture of *Bacillus coli* received from Prof. Theobald Smith. The temperature during this experiment varied from 18° to 22° C.

TABLE XXI.—*Effect of carbon dioxid upon toxicity of copper sulfate to Bacillus coli.*[1]

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—				
		10,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	9,200	8,200	5,800	11,600	7,500	6,200
2 hours	2,000	0	110	38	900	350

[1] Experiment conducted in Weber resistance glass test tubes, each containing 10 c. c. of water triple distilled from glass, portions of which had been treated previously with the desired amount of copper sulfate. All tubes inoculated with a 2 mm. loop of culture of *Bacillus coli* received from Prof. Theobald Smith. The temperature during this experiment varied from 18° to 22° C.

TABLE XXII.—*Effect of water containing calcium monocarbonate and various quantities of copper sulfate upon Bacillus coli.*[1]

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—				
		10,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	2,950	3,510	2,670	3,150	4,290	3,760
6 hours	240	0	0	0	105	80
24 hours	5	0	0	0	0	0

[1] Various dilutions of copper sulfate were tubed in Weber resistance glass, thoroughly boiled, a small measured quantity of calcium carbonate added to each tube, and these solutions cooled and kept in a Novy jar in an atmosphere free of carbon dioxid. All tubes inoculated with a 2 mm. loop of culture of *Bacillus coli* received from the Bureau of Animal Industry and isolated from hog. The temperature during this experiment varied from 18° to 22° C.

TABLE XXIII.—*Effect of carbon dioxid content of water containing calcium carbonate and various quantities of copper sulfate upon Bacillus coli.*[1]

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—				
		10,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	4,650	4,730	3,850	3,980	4,100	4,470
6 hours	4,500	0	0	5	415	620
24 hours	5,200	0	0	0	15	60

[1] Various dilutions of copper sulfate were tubed in Weber resistance glass, thoroughly boiled, a small measured quantity of calcium carbonate added to each tube, and these solutions cooled and kept in a Novy jar in an atmosphere composed largely of carbon dioxid. All tubes inoculated with a 2 mm. loop of culture of *Bacillus coli* received from the Bureau of Animal Industry and isolated from hog. The temperature during this experiment varied from 18° to 22° C.

TABLE XXIV.—*Toxicity of copper sulfate to Bacillus coli in tap water free of carbon dioxid.*[1]

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—				
		10,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	6,300	7,600	6,000	1,050	4,800	5,200
2 hours	1,500	0	0	0	Lost.	60
6 hours	280	0	0	0	0	0
24 hours	0	0	0	0	0	0

[1] Experiment conducted in Weber resistance glass test tubes, each containing 10 c. c. of Potomac tap water, portions of which had been treated previously with the desired amount of copper sulfate. All tubes inoculated with a 2 mm. loop of culture of *Bacillus coli* received from the Bureau of Animal Industry, isolated from hog. The temperature during this experiment varied from 18° to 22° C.

TABLE XXV.—*Toxicity of copper sulfate to Bacillus coli in tap water free of carbon dioxid.*[1]

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—				
		10,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	4,600	1,800	4,800	3,700	4,500	4,000
2 hours	1,450	0	0	20	80	100
6 hours	1,500	0	0	0	5	2
24 hours	250	0	0	0	0	0

[1] Experiment conducted in Weber resistance glass test tubes, each containing 10 c. c. of Potomac tap water, portions of which had been treated previously with the desired amount of copper sulfate. All tubes inoculated with a 2 mm. loop of culture of *Bacillus coli* received from Prof. Theobald Smith. The temperature during this experiment varied from 18° to 22° C.

TABLE XXVI.—*Effect of carbon dioxid upon toxicity of copper sulfate to Bacillus coli.*[1]

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—				
		10.000 parts of water.	50,000 parts of water.	100,000 parts of water.	500.000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	4,200	4,000	9,800	1,270	5,100	1. 100
2 hours	2,800	10	0	0	110	260
6 hours	1,460	15	15	20	10	35
24 hours	1,540	0	0	0	0	0

[1] Experiment conducted in Weber resistance glass test tubes, each containing 10 c. c. of Potomac tap water, portions of which had been treated previously with the desired amount of copper sulfate. All tubes inoculated with a 2 mm. loop of culture of *Bacillus coli* received from the Bureau of Animal Industry, isolated from hog. The temperature during this experiment varied from 18° to 22° C.

TABLE XXVII.—*Effect of carbon dioxid upon toxicity of copper sulfate to Bacillus coli.*[1]

Duration of exposure to action of copper sulfate.	Check.	1 part copper sulfate to—				
		10,000 parts of water.	50,000 parts of water.	100,000 parts of water.	500,000 parts of water.	1,000,000 parts of water.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	3,800	3,000	8,500	5,200	4,400	5,500
2 hours	2,300	0	5	15	2,150	1,500
6 hours	1,600	10	12	10	120	100
24 hours	3,500	0	0	10	35	0

[1] Experiment conducted in Weber resistance glass test tubes, each containing 10 c. c. of Potomac tap water, portions of which had been treated previously with the desired amount of copper sulfate. All tubes inoculated with a 2 mm. loop of culture of *Bacillus coli* received from Prof. Theobald Smith. The temperature during this experiment varied from 18° to 22° C.

An examination of the foregoing tables shows that with the three types of water the presence of carbon dioxid increases the resistance of the bacilli in question. In the solution containing monocarbonate of lime and copper sulfate the bacteria are extremely sensitive, even the bacteria in the check solutions dying rapidly, while in the solutions charged with carbon dioxid the bacteria were able to persist in considerable numbers in the dilute copper solutions in spite of the fact that most of the copper must have remained in solution. This point is interesting in connection with the work of Engels,[a] who reports a rather high toxicity for calcium chlorid, and of Pfuhl,[a] who suggests a calcium salt—milk of lime—for water sterilization. The use of lime or a similar agent may be highly desirable in connection with treating a contaminated reservoir with copper, though the inferior germicidal power of lime makes it improbable that the latter alone could be used safely.

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[a] Weitere Studien über die Sterilization von Trinkwasser auf chemischen Wege. Centralbl. f. Bakt., Parasit., u. Infekt., vol. 32 Orig., 1902, pp. 495–521.

In regard to chemical water analysis, it seems probable that the determination of carbon dioxid or the determination of monocarbonate and bicarbonate alkalinity may have importance hitherto unrecognized, and the variations in the longevity determinations of *Bacillus coli* and *Bacillus typhi* may be due in part to the mineral constituents of a water, in part to methods of experimentation, and in part to the carbon dioxid content. Extended field tests must be made before generalizations on the possible effect of the gas content of a water supply can be determined.

The carbon dioxid content of a water may possibly explain the peculiar results obtained by Clark and Gage.[b] They have reported practically no toxic action from metallic copper, or at least very little difference in the action of metallic copper, iron, tin, zinc, and lead. Their figures are rather misleading because of the great number of days the experiments were carried on, and, as Phelps[c] has shown, metallic copper is coated with some insoluble substance after a few days' exposure to Boston tap water and no longer has great toxic action. The lack of toxicity of metallic copper and the similarity of its action to the action of other metals, as reported by Clark and Gage, is entirely at variance with the work of Kraemer,[d] Pennington,[e] Gildersleeve,[f] Stewart,[g] and Moore and Kellerman.[h] Investigators generally have agreed that it would be possible to practically sterilize drinking water by exposing it to the action of clean metallic copper.[a] Perhaps this opinion should be qualified by adding that the action is more rapid if the water contains no free carbon dioxid, although the following tables show only slight differences between the toxicity of metals because of the presence or absence of carbon dioxid.

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[a] Über die Disinfection der Typhus and Cholera-ausleerungen mit Kalk. Zeitschr. f. Hyg. u. Infekt., vol. 6–8, 1889, pp. 97–104.

[b] The Use of Copper Sulphate in Water Filtration. Journal of Infectious Diseases. Supplement No. 2, February, 1906, pp. 172–174.

[c] Experiments on the Storage of Typhoid Infected Water in Copper Canteens. Public Health Papers and Reports, American Public Health Association, vol. 31, part 1, 1905, pp. 75–90.

[d] Copper Treatment of Water. American Journal of Pharmacy, vol. 76, December, 1904, pp. 574–579.

The Use of Copper in Destroying Typhoid Organisms and the Effects of Copper on Man. American Journal of Pharmacy, vol. 77, June, 1905, pp. 265–281.

[e] The Action of Electrically Charged Copper Upon Certain Organisms in Water. American Journal of Medical Science, vol. 129, 1905, pp. 751–754.

[f] Studies on the Bactericidal Action of Copper on Organisms in Water. American Journal of Medical Science, vol. 129, 1905, pp. 754–760.

[g] A Study of the Action of Colloidal Solutions of Copper upon Bacillus Typhosus, American Journal of Medical Science, vol. 129, 1905, pp. 760–769.

[h] Buls. 64 and 76, Bureau of Plant Industry, U. S. Dept. of Agriculture.

TABLE XXVIII.—*Effect of carbon dioxid upon toxicity of metals to Bacillus coli.*[1]

Duration of exposure to action of metals.	Check.	Copper.	Iron.[2]	Zinc.	Lead.	Tin.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	3,700	1,100	3,300	3,050	3,700	3,500
4 hours	440	75	30	125	275	410
8 hours	305	3	3	30	120	190

[1] Experiment conducted in Weber resistance glass test tubes, each containing 10 c. c. of water triple distilled from glass, to portions of which were added sterile blocks of the proper metals, each having approximately 2 sq. cm. surface area. All tubes inoculated with a 2 mm. loop of culture of *Bacillus coli* received from Prof. Theobald Smith. The temperature during this experiment varied from 18° to 22° C.

[2] Iron impure and presumably more toxic than pure iron. (See Table No. XXII.)

TABLE XXIX.—*Toxicity of metals to Bacillus coli in the absence of carbon dioxid.*[1]

Duration of exposure to action of metals.	Check.	Copper.	Iron.[2]	Zinc.	Lead.	Tin.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	2,950	2,350	1,200	1,450	1,300	1,600
4 hours	965	10	10	65	40	770
8 hours	740	0	0	5	5	700

[1] Experiment conducted in Weber resistance glass test tubes, each containing 10 c. c. of water triple distilled from glass, to portions of which were added sterile blocks of the proper metals, each having approximately 2 sq. cm. surface area. All tubes inoculated with a 2 mm. loop of culture of *Bacillus coli* received from Prof. Theobald Smith. The temperature during this experiment varied from 18° to 22° C.

[2] Iron impure and presumably more toxic than pure iron. (See Table No. XXII.)

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[a] There is a seeming discrepancy in this statement due to the fact that Mr. Earle B. Phelps, assistant hydrographer, U. S. Geological Survey, has carried on experiments on the storage of typhoid infected water in copper canteens, some results of which, with conclusions of a nature unfavorable to the use of metallic copper in practically sterilizing water, were issued in a press circular of the Geological Survey. A quotation from Mr. Phelps's paper paralleled with a quotation from Bureau of Plant Industry Bulletin No. 76 shows clearly that Mr. Phelps's work is a corroboration instead of a contradiction of the fact reported in Bulletin No. 76 that metallic copper has a high germicidal value. Mr. Phelps has stated: "The fact that organisms do survive the copper treatment even in small numbers [Per cent reduction usually over 99.999.—K. F. K.] seems, in the writer's view, to lessen considerably the value of the canteen as a safeguard against typhoid infection. A second point of interest is the fact that the efficiency of the canteen decreases as time goes on, probably owing to the accumulation on the surface of the copper of a film of basic carbonate or other insoluble copper compound." A paragraph from Bureau of Plant Industry Bulletin No. 76 reads as follows: "Complete sterilization is a standard to which even the best filters seldom attain, and under the most unfavorable conditions the reduction in the number of bacteria in water exposed to the action of metallic copper for twelve hours will be approximately as great as filtered water. The copper must be kept clean, not, as is popularly supposed, to protect the consumer from copper poisoning, but because it is possible for the metal to become so coated with foreign substances that there is no longer any contact of copper and water, and hence no antiseptic action."

To determine whether the peculiar variation in the germicidal power of solutions or metals is due to the use of ordinary laboratory glassware made of a rather soluble glass instead of carefully selected highly insoluble glass, a parallel series in good and poor glass was carried on. The following tables show the slight difference in results:

TABLE XXX.—*Effect of glass upon toxicity of metals to Bacillus coli.*[1]

Duration of exposure to action of metals.	Check.	Copper.	Iron.	Zinc.	Lead.	Tin.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	2,600	1,925	1,850	2,450	2,600	3,100
2 hours	2,650	775	2,100	715	2,800	2,300
6 hours	2,700	525	2,350	70	2,450	4,200
24 hours	28,000	15	4,350	1	13,750	12,000

[1] Experiment conducted in ordinary glass test tubes each containing 10 c. c. of water triple distilled from glass, to portions of which were added sterile blocks of the proper metals, each having approximately 2 sq. cm. surface area. All tubes inoculated with a 2 mm. loop of culture of *Bacillus coli* received from Prof. Theobald Smith. The temperature during this experiment varied from 18° to 22° C.

TABLE XXXI.—*Effect of glass upon toxicity of metals to Bacillus coli.*[1]

Duration of exposure to action of metals.	Check.	Copper.	Iron.	Zinc.	Lead.	Tin.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	2,300	4,825	4,750	2,400	2,800	3,000
2 hours	1,572	975	2,400	200	1,800	3,600
6 hours	1,400	190	3,050	20	2,000	3,850
24 hours	10,825	1	6,700	1	19,000	14,000

[1] Experiment conducted in Weber resistance glass test tubes each containing 10 c. c. of water triple distilled from glass, to portions of which were added sterile blocks of the proper metals, each having approximately 2 sq. cm. surface area. All tubes inoculated with a 2 mm. loop of culture of *Bacillus coli* received from Prof. Theobald Smith. The temperature during this experiment varied from 18° to 22° C.

COPPER SULFATE AND FILTRATION.

The use of copper sulfate in connection with filtration has been mentioned in previous bulletins. Further experiments in this field show that in mechanical filtration with alum it is necessary to limit the use of copper sulfate to treatment some hours before coagulation. When solutions of aluminum sulfate and copper sulfate are mixed and alkali or hard water is added in quantities sufficient to cause precipitation the copper is coagulated at once, while the aluminum is deposited on the copper and incloses it, with the result that the copper-alum coagulum is no more toxic than is the pure alum coagulum. When copper and iron salts are precipitated together the reverse of this seems to take place and the precipitate retains its toxic properties.[a]

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[a] See also H. W. Clark, Sulphate of Alumina as a Germicide. Thirty-sixth Annual Report of State Board of Health of Massachusetts, 1904, p. 288.

The following table shows the various combinations of precipitates tested and the exact results:

TABLE XXXII.—*Toxicity of combined precipitates to Bacillus coli.*[1]

Duration of exposure to action of precipitate.	Check.	Copper hydrate.	Iron hydrate.	Aluminum hydrate.	Copper and iron hydrate.	Copper and aluminum hydrate.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	2,250	1,525	645	7,750	3,450	1,750
2 hours	675	0	230	1,800	25	350
6 hours	465	0	230	195	0	15
24 hours	165	0	230	5	0	1

[1] Experiment conducted in 100 c.c. Jena glass flasks, each containing 15 mg. of the proper precipitate. All flasks inoculated with a 2 mm. loop of culture of *Bacillus coli* received from Prof. Theobald Smith. The temperature during this experiment varied from 18° to 22° C.

TABLE XXXIII.—*Toxicity of combined precipitates to Bacillus coli.*[1]

Duration of exposure to action of precipitate.	Check.	Copper hydrate.	Iron hydrate.	Aluminum hydrate.	Copper and iron hydrate.	Copper and aluminum hydrate.
	Colonies.	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*	*Colonies.*
0 hour	3,350	380	1,065	2,650	3,100	2,350
2 hours	305	0	1,900	3	1	80
6 hours	350	1	1,350	1	0	0
24 hours	200	0	850	1	0	0

[1] Experiment conducted in 100 c.c. Jena glass flasks, each containing 15 mg. of the proper precipitate. All flasks inoculated with a 2 mm. loop of culture of *Bacillus coli* received from the Bureau of Animal Industry, isolated from hog. The temperature during this experiment varied from 18° to 22° C.

The presence or absence of carbon dioxid is probably important in this connection. If the laboratory results will hold for field conditions, a copper precipitate or a precipitate of iron and copper will be highly toxic to *Bacillus coli* and *Bacillus typhi* in a water whose alkalinity is chiefly monocarbonate; and, conversely, the action of a copper precipitate or a copper-iron precipitate will be reduced if a water contains free carbon dioxid. This is probably the reason that small quantities of copper are toxic[a] in a mechanical filter using the proper quantities of iron and copper, and gives an additional reason for the advice given by Ellms[b] and Brown[c] that before filtration or distribution of a copper-treated water all free carbon dioxid and part of the semicombined carbon dioxid should be neutralized by caustic lime. Copper treatment of water previous to slow sand filtration should be made under similar conditions, and as this is seldom practicable it is perhaps advisable to limit the use of copper in connection with slow sand filtration to treatment after passing the filter, and before distribution the proper quantity of caustic lime may be added. An excellent example of the results to be expected from incorrect use of copper in connection with slow sand filtration is furnished in Clark's[a] report. Not only was copper found in the effluent of the experimental filter, but *Bacillus coli* was found in a rather high per cent of the bacterial samples.

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[a] Bul. 76, Bureau of Plant Industry, U. S. Dept. of Agriculture.

[b] Journal New England Water Works Association, vol. 19, 1905, pp. 496–503.

[c] Journal New England Water Works Association, vol. 19, 1905, p. 578.

The carbon dioxid content of the Ohio River is a possible explanation also of the fact reported by Brown[b] that samples of Ohio River water yielded between 0.00772 and 0.00657 grain of metallic copper to the gallon, though *Bacillus coli* was occasionally present. To use his own words, "It is seen from the work done, as above stated, that the copper is present in an insoluble form and probably as the oxid united with the suspended mineral matter which the water carries. If in this form it would be unable to exert any germicidal power, and, as far as could be determined, this seems to be the case. It was decided that the copper was present in a spent condition." As there was no monocarbonate alkalinity noted, the Ohio River water at this time doubtless contained some free carbon dioxid, and from the analogy of the laboratory results it seems fair to assume that Brown's explanation must be supplemented by the theory of the heightened resistance of *Bacillus coli* due to carbon dioxid.

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[a] Journal New England Water Works Association, vol. 19, 1905, pp. 503–505.

[b] The Purification of Water at Marietta, Ohio. Official Report to Board of Public Service, 1906.

B. P. I.—238.

VIII.—CONDITIONS AFFECTING LEGUME INOCULATION.[a]

By Karl F. Kellerman, *Physiologist in Charge of Soil Bacteriology and Water Purification Investigations*, and T. R. Robinson, *Assistant Physiologist.*

INTRODUCTION.

The widespread use of bacteria for inoculating leguminous crops has made possible more accurate study of the conditions under which a particular species of legume might be successfully inoculated and the conditions under which failure to obtain inoculation might be expected. Inoculation tests carried on in different soils and under different cultural and climatic conditions but using the same stock culture have shown results so conflicting in certain cases that one is bound to be misled by any general statement based on one factor alone, such, for instance, as the condition of the bacteria used.

To accept as indicative of the general usefulness of pure cultures results obtained on a single type of soil is clearly opposed to progress along a line of investigation now recognized as closely connected with soil fertility problems. The advantage of numerous tests covering many types of soil becomes increasingly apparent. The effect of prevailing cultural practices is no less to be considered; aeration by cultivation, the use of lime, and the effect of such factors on the bacterial flora, the bacteriological testing of the soil itself—all these problems call for extensive field experiments to determine how far they may become part of practical routine for successful farming.

The work here recorded emphasizes the intimate connection of soil bacteriology with certain phases of soil fertility. Soil fertility is a strictly relative term; it is possible for a soil to be fertile in regard to one crop and unfertile in regard to another, the conditions of temperature and moisture being optimum in each case. The interaction between prevailing soil conditions and biological phenomena becomes apparent at once and lends confirmation to the belief that in practice œcological conditions may be so modified as to promote the activity of the desirable organisms and retard the development of the undesirable, although under certain conditions the control of the bacterial flora undoubtedly will depend upon the introduction of virile cultures of desirable bacteria.[a]

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[a] The identification of soil bacteria and their distribution in and correlation with different types of soil, the changes in the bacterial flora with different modes of treatment and different systems of rotation, the individual and combined action of the species in producing changes in the soil favorable or unfavorable to plant growth, the introduction of favorable species and groups of species and their improvement by selection or special cultivation, and the elimination of unfavorable forms are problems calling for extended investigation; but with the information already at hand and work under way both in this country and in Europe it is not too much to expect large increases in our present knowledge along these lines.—B. T. Galloway, *Pathologist and Physiologist, and Chief of Bureau.*

USE OF LIME.

Samples of soil have been obtained from fields in various parts of the United States where attempts to inoculate legumes have failed, and greenhouse tests have been made combining various quantities of air-slaked lime with these soils. The effect of applying lime to certain types of soils is rather striking when nodule formation is considered.[b] This is especially true of those soils which give an acid reaction to litmus,[c] although several of these unfavorable soils did not give an acid reaction to litmus, but were nevertheless benefited by lime. Outlines of a few typical cases selected from our experiments follow.

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[a] The fact as shown in numerous cases that legumes can be successfully inoculated by the use of pure cultures of the nodule-forming organisms with a consequent large gain in yield and amount of nitrogen fixed is in conflict with the statement that "An enhancement of the desirable bacterial activities of the soil can only be encouraged by the proper improvement in the physical and chemical composition of the soil." (Lipman, "The Measure of Soil Fertility from the Nitrogen Standpoint," N. J. Agr. Expt. Sta. Rept., 1905, p. 243.)

[b] Fruwirth. Neue Impfversuche mit Lupinen. Deutsche Landw. Presse, vol. 18, 1892, pp. 18 and 127.

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Tacke. Action de la chaux vive sur les bactéries des tubercules des légumineuses. Centralbl. f. Agriculturchemie, vol. 25, 1896, p. 297.

[c] G. A. Billings (N. J. Agr. Expt. Sta. Rept., 1905, p. 358) shows the efficient action of lime in promoting the growth of alfalfa and that the vigor of the plants seemed to be correlated with the form and greater abundance of root nodules. He suggests that soil acidity, conditions of ventilation or soil porosity, and different bacteria which may influence the form of the nodules are determining factors, controlled at least partially by the action of lime.

A quantity of soil was obtained from Blue Hill, Me., where the culture tried last year had shown no benefit with garden peas. One portion of this soil was placed in ordinary greenhouse pots; a second portion was thoroughly mixed with pulverized lime at the rate of 1 ton to the acre, approximately, and placed in similar pots, and inoculated seed sown in half of each series. Of 15 plants unlimed, 10 were without nodules, 5 having a single nodule each; of 17 plants limed, 15 were well noduled and 2 apparently free, but nodules were evident on close examination. The uninoculated pots in the unlimed series had no nodules; in the limed series there were only a few scattering nodules, the majority of the plants, 10 out of 18, being free.

This experiment was repeated, the soil itself being inoculated with the liquid culture, with results even more striking. Of 17 plants unlimed, 12 were without nodules, 5 having a total of 8 nodules; of 16 plants limed, all were well noduled, having a total of 87 nodules. The uninoculated pots in the unlimed series had no nodules; in the limed series, 15 out of 17 plants had no nodules, the other two having a single nodule each.

The combination of liming and inoculation was again strikingly shown with alfalfa grown in a poor sandy soil from Lanham, Md. In this case it seems reasonable to assume that alfalfa bacteria of low virility were present in the soil. Under the normal unfavorable soil conditions the native bacteria were unable to produce inoculation, and the virile ones from the pure culture, while able to inoculate the alfalfa plants, could benefit them only slightly. In the limed soil, however, the native bacteria were able to produce nodules in considerable numbers and to be of moderate benefit to the plants. The pure cultures of virile bacteria under similar conditions, however, caused more than double the increase that may be ascribed to the native bacteria.

The following table shows the relative virility of the two types of alfalfa bacteria in soil from Lanham:

Treatment.	Number of plants.	Number of nodules.	Average height.	Average dry weight.
Lime:			*Inches.*	*Grams.*
Inoculated	9	12	15.5	0.39
Uninoculated	13	15	13	.15
No lime:				
Inoculated	10	11	10	.09
Uninoculated	9	0	9	.06

Similar results were obtained with a large number of soils concerning which unfavorable reports had been received regarding attempts at inoculation with cultures furnished by the Department of Agriculture. Field observations on the nodule formation of various legumes showed the effectiveness of using lime or some other agent to counteract the influence of substances in the soil unfavorable to the growth of the bacteria.[a]

EFFECT OF SOIL CONDITIONS UPON BACTERIA.

The constitution or character of the soil solution has great effect upon the growth of nodule bacteria as well as upon the formation of nodules. In the large number of soil samples tested simultaneously in the greenhouse and in the laboratory it seems to hold true generally that the possibility or impossibility of securing effective inoculation on a particular crop in a certain soil can be predicted by the relative growth of the specific culture in the sterile extract of the soil in question. There also seems to be a somewhat close relation between the soil solution necessary for the growth of host and bacteria, so that in many cases, at least, it is possible to determine the suitability of a legume crop to a certain soil by the growth of the specific culture of *Pseudomonas radicicola* in the extract of the soil. The probability of an extract not truly representing the soil solution and the disturbing factor of sterilizing certain extracts will in some cases introduce error in interpreting results. The use of sterilized soil extracts as culture media for the bacteria has been found to give fairly true indications of the growth of the respective hosts of these bacteria in a considerable series already tested, however, and contemplated improvements in technique will doubtless increase the probability of securing trustworthy indications. The testing of the soil extract in its behavior toward specific bacteria may even indicate that some treatment is necessary, but can not prescribe the method of amelioration, and for the present direct experimentation is necessary to determine the proper treatment of an unsuitable soil.

As an example of the relation between the growth of the specific bacteria in the sterile soil extract and the growth of the legume host in this soil may be cited the following result of a fairly representative test, using different quantities of lime on an unfavorable soil which responded favorably to treatment with lime:

Quantity of lime.	Green weight of plant.	Number of nodules.	Number of bacteria in a cubic centimeter of soil extract.
	Grams.		
Unlimed	2.5	31	87
Limed:			
2,000 pounds to the acre	5.5	68	71,950
4,000 pounds to the acre	8.5	88	128,650

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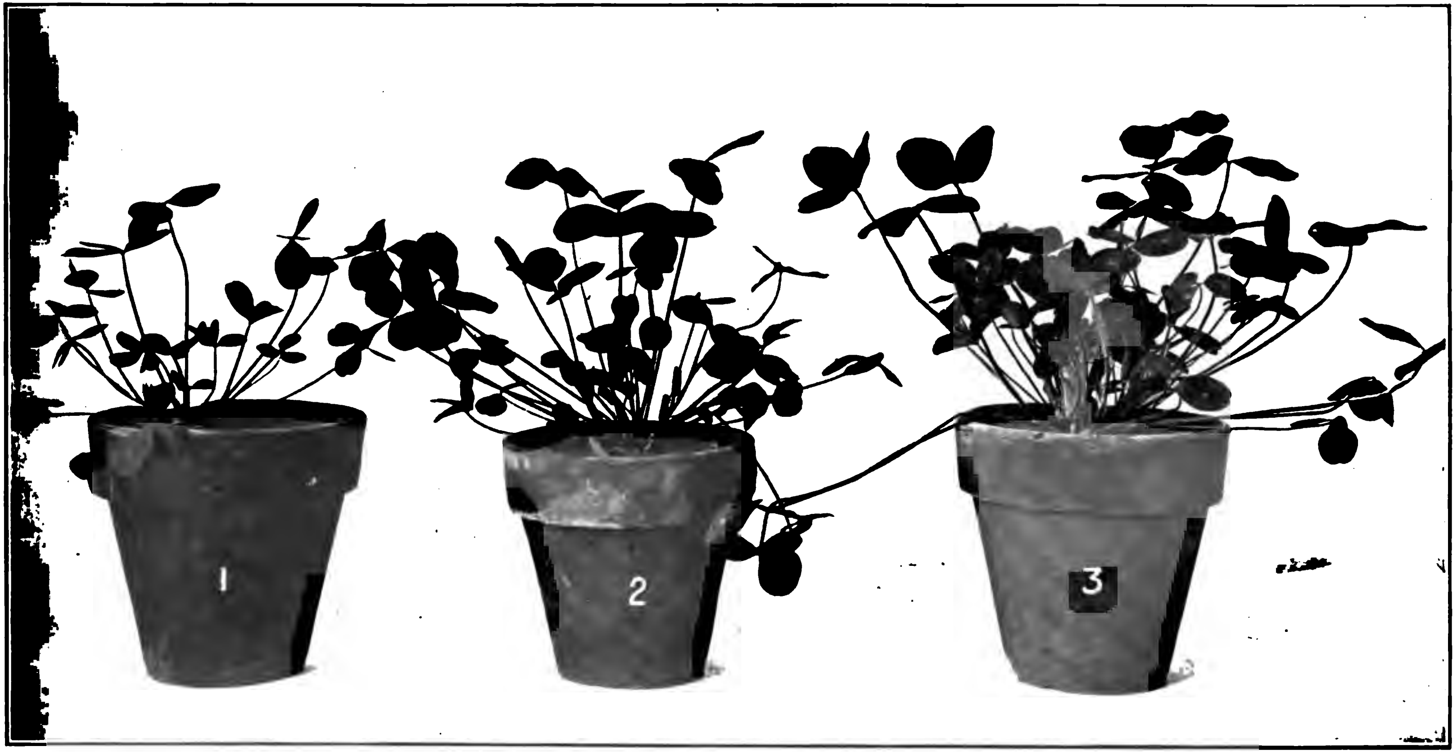
[a] For the presence of substances in poor soils deleterious to higher plants, see Bureau of Soils Bul. No. 28, 1905, "Studies on the Properties of an Unproductive Soil."



POTS OF RED CLOVER, SHOWING THE EFFECT OF LIME ON A SOIL UNFAVORABLE TO THE GROWTH OF CLOVER.

1.—Unlimed. 2.—Limed at the rate of 2,000 pounds to the acre. 3.—Limed at the rate of 4,000 pounds to the acre.

The accompanying illustration (Pl. VIII) shows characteristic pots of red clover from a series of soils from South Salem, N. Y., where clover had been steadily diminishing in vigor for years. The nodules on the unlimed plants were small and clustered around the crown of the plant, while the limed plants showed numerous nodules well distributed. The stand secured in a series of limed pots was four times as heavy as without the use of lime.

In comparison with this unfavorable soil, the extract obtained from soil sent in from a favorable field test at Carlisle, Pa., gave an excellent growth of the red clover bacteria, and the inoculated red clover grown in this soil in pots showed numerous nodules and a better growth than in the uninoculated pots, thus confirming results obtained in the field.

It may be noted that there is a difference exhibited among different legumes in their behavior toward lime. While for most legumes its effect is beneficial, a few species, such as lupine and serradella, are actually injured by its use[a] and some other legumes, such as Lima bean and cowpea, do not respond to lime even in soils where clover refuses to grow without lime. It has been noted[b] that serradella is not successful when following red clover, and that results are also unsatisfactory when red clover follows serradella. These varying relations shown by legumes belonging to different groups in their relation to lime and other conditions emphasize the necessity of determining as accurately as possible the adaptability of different soils to the crops for which they are intended.

Observations upon the occurrence of nodules in certain soils have been found to correspond quite closely with the behavior of the soil solution toward the bacteria of the legumes tested. The preceding table illustrates this point, though perhaps not so clearly as the following examples.

In the case of a fairly rich garden soil, soy beans would not form nodules even after very heavy inoculation, and the extract from this soil used as a culture medium was found to inhibit the growth of the soy bean bacteria. On the other hand, alfalfa readily formed nodules in this soil and the soil extract was not unfavorable to the growth of the alfalfa bacteria.

A soil from Niles, Mich., which had grown a fair crop of soy beans for four years without the occurrence of nodules, was tested. The soil extract in this case was found unfavorable to the growth of the soy bacteria. In greenhouse pot tests soy beans of several varieties failed to produce any nodules in this soil even when heavily inoculated with cultures which produced abundant nodules in other soils tested in comparison. Heavy liming of the soil extract at the rate of about 6,000 pounds to the acre gave a fair growth of the bacteria, and corresponding to this result one pot that received lime in the same proportion produced a well-noduled plant. In this same soil without lime and without inoculation cowpeas formed nodules abundantly.

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[a] See Rhode Island Agr. Exp. Sta. Rept., 1896, p. 256; also Bul. 96 of same station, 1903.

[b] Deutsche Landw. Presse, vol. 32, 1905, p. 799.

A soil from Lanham, Md., gave an extract which as a culture medium was distinctly unfavorable to the growth of red clover bacteria, and plants of red clover in this soil made a very sickly growth. producing few nodules. A few pots were boiled by immersing in a tub of water and blowing live steam into the water; the soil was of a sandy character, so that there was little danger of puddling from this treatment. The growth of red clover was markedly improved in the boiled series and the roots were well noduled after inoculation. The extract of this soil, sterilized by boiling, had proved an unfavorable medium for the growth of the bacteria. It is probable, therefore, that boiling the soil changed the character of the soil solution at least in regard to the unfavorable materials or conditions which had inhibited bacterial activity.

Soil from Lanham, Md., was further tested with alfalfa, treating the soil in three ways: (1) Lime at the rate of one ton to the acre; (2) lime and one-fourth humus, composed of leaf mold; (3) humus. The combination of lime and humus gave the greatest growth and most abundant nodule formation. With humus alone the growth was especially inferior and nodules were lacking even where the soil was inoculated. Inoculation doubled the number of nodules where lime was used and increased them six times where both lime and humus were used.

Effect of humus and lime upon the growth of alfalfa in soil from Lanham, Md.

[Ten plants in each series.]

Treatment.	Average (green) weight of plant.	Average number of nodules.
Lime alone:	*Grams.*	
Uninoculated	0.86	0.5
Inoculated	1.56	1.0
Humus alone:		
Uninoculated	.5	0
Inoculated	.8	0
Humus and lime:		
Uninoculated	.73	1.4
Inoculated	2.45	8.6
No lime; no humus:		
Uninoculated	(*)	.3
Inoculated	(*)	.5

* Not weighed; growth so small as to be a practical failure—2 to 5 inches as compared with 12 to 18 inches high in the limed pots or those containing lime and humus.

The sterilized extracts of soil from this series of pot tests gave results seemingly contradictory when used as culture media for bacteria in comparison with the growth of plants and nodules. The extract of untreated soil gave a growth of the alfalfa bacteria which might be designated "fair," while with lime, with lime and humus, and with humus alone the extracts gave uniformly a growth which might be designated "excellent." In the pots, however, no nodules developed in the humus series. The sterilization by heat of the extract from a soil containing such a relatively large quantity of humus, one-fourth by volume, probably changes the material so that the solution becomes favorable to the growth of the bacteria, but this material in the soil pots, not heated, remains unchanged and may in this form be unfavorable to the activity of the bacteria introduced into the soil.

Aside from the effect of the soil on nodule formation there seems to exist a marked difference among different varieties of legumes in their susceptibility to infection—that is, their readiness to form nodules. With a similar soil and one which is favorable to the growth of the respective species, nodules will occur in abundance upon one species or variety and another species or variety will exhibit none or only a few. This is particularly noticed with varieties of soy beans and with certain species of Phaseolus, the Lima bean (*Phaseolus lunatus*) and some varieties of soy beans being very difficult to inoculate. It would seem that such species were actually resistant to infection, especially in soils rich in nitrogenous matter.

EFFECT OF HEAVY INOCULATION.

The decided advantage of very heavy applications of pure cultures reported from some field and pot experiments and reports of other experiments showing that cultures diluted to almost infinitesimal limits gave as good results as undiluted cultures seem at first diametrically opposed. Greenhouse tests seem to confirm the beneficial effect to be expected from heavy inoculation provided excessive quantities of culture are applied. The following experiment is fairly representative:

Effect of light and heavy inoculation of garden peas on soil from Blue Hill, Me.

Treatment.	Number of plants grown.	Number of plants with nodules.	Average number of nodules.
Check, without inoculation	11	2	1
Light inoculation	9	6	3
Heavy inoculation	6	6	7

It is here shown that heavy inoculation not only doubled the average number of nodules upon inoculated plants, but insured all plants becoming infected; while with light inoculation in this unfavorable soil one-third of the plants failed to produce nodules, and with no inoculation nodules were almost entirely lacking.

Garden peas in a garden soil naturally inoculated showed the following difference where a heavy inoculation was made:

Effect of heavy inoculation of garden peas on a naturally inoculated garden soil.

Treatment.	Number of plants grown.	Number of plants with nodules.	Average number of nodules.
Untreated	15	15	6½
Heavy inoculation	18	18	19

It is highly probable that the cause of the formation of more numerous nodules in some cases is due not to the great numbers of bacteria which are introduced into the soil but to the quantity of culture medium introduced, which renders the soil solution a materially richer food for the active growth of the nodule organisms. Thus, if a few bacteria are brought into a favorable soil they will multiply rapidly, and it is of no particular moment in such a case whether a very few or a large number of bacteria are originally introduced. If, however, enough culture is added so that the soil solution is appreciably improved in food material for both plant and bacteria, then growth will be much more active and nodule formation will be greater. On this hypothesis the two results are not at all at variance, the effects produced depending on the soil conditions encountered by the bacteria and the crop.

The suggestion in a former bulletin[a] that the slight varietal characteristics exhibited by legume bacteria can be readily broken down by cultivation on synthetic nitrogen-poor media seems to hold only for bacteria isolated from plants physiologically related to the subsequent hosts.[b]

A typical experiment is given below:

Number of nodules produced on two varieties of mung bean (Phaseolus viridissimus and P. calcaratus) by cultures from various hosts.

[Ten plants in each of seven series.]

Variety of mung bean.	Bacteria from cowpea.	Bacteria from soy bean.	Bacteria from P. viridissimus.	Without bacteria.
Phaseolus viridissimus	*1	0	77	0
Phaseolus calcaratus	0	0	88	0

*Fifteen plants in this series.

It may be added that the soil used was unsterilized garden soil, naturally inoculated for our common bean, *Phaseolus vulgaris*, so that the uninoculated check may be said to serve as a cross-inoculation with these organisms also. This theory of varietal differences of nodule-

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[a] Bul. 71, Bureau of Plant Industry, 1905, pp. 25–27.

[b] See Schneider, Ill. Agr. Exp. Sta. Bul. 29, 1894, p. 301.

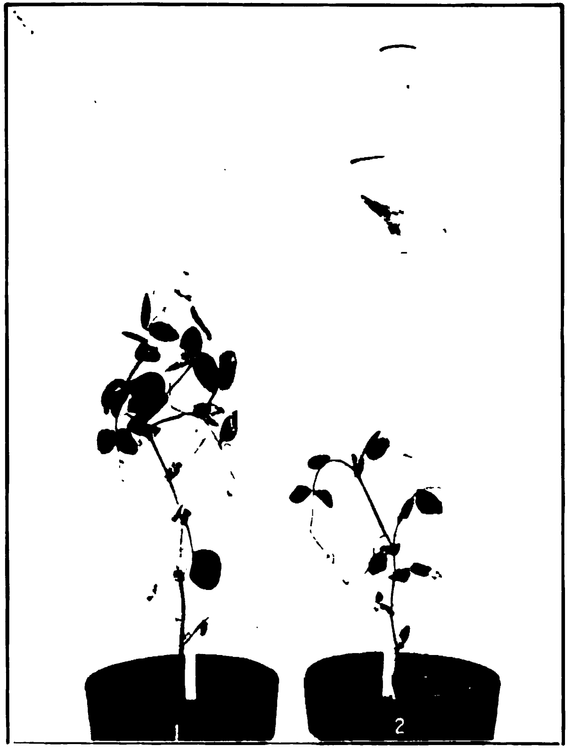

FIG. 1.—POTS OF GARDEN PEAS, SHOWING THE EFFECT OF AERATION ON GROWTH.

1.—Ordinary unglazed pot; surface of soil frequently stirred.

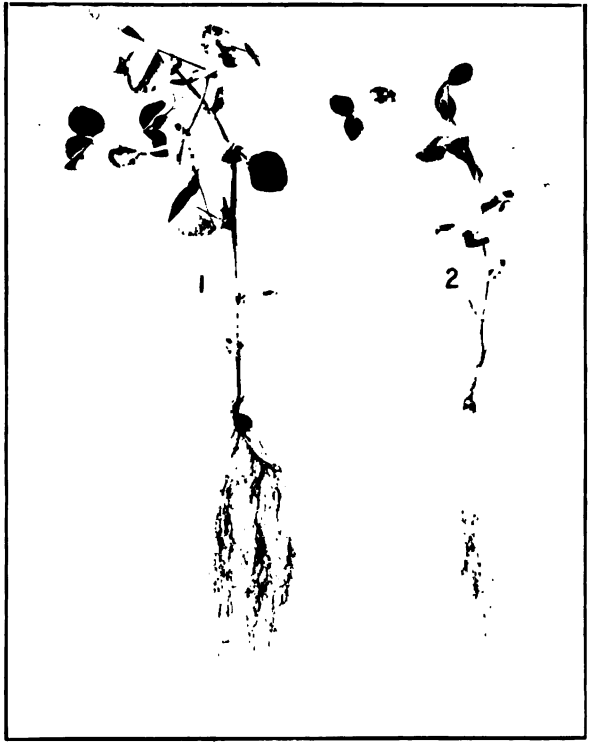

FIG. 2.—THE GARDEN PEAS ILLUSTRATED IN FIGURE 1, SHOWING THE EFFECT OF AERATION ON NODULE FORMATION.

1.—Plant from unglazed, aerated pot. 2.—Plant from glazed pot

forming bacteria is closely in accord with field results reported by various investigators, among whom perhaps Hopkins[a] is best known for his observations upon the cross-infection between sweet clover and alfalfa and the absence of such cross-infection between many other legumes.

EFFECT OF AERATION.

The aeration of soil for securing plentiful nodule formation is an important if not a determining factor. The Ontario Agricultural Experiment Station (Report for 1905, p. 39) reports a decided gain from aeration in the case of a leguminous crop (peas) and no gain from the aeration of a wheat crop. In the former case the result may be either a direct one, affecting the activity of the nodule bacteria, or it may be that because of the abnormal growth of the host plant the bacteria are unable to penetrate the root.[b]

Our own experiments upon the effect of aeration are in accord with those quoted in regard to the legumes, and the following is typical: A light sandy soil, moderately limed, was used and the legume selected was the garden pea. The aerated series was started in ordinary unglazed 4-inch pots, seedlings dipped in liquid culture when placed in position, pots watered with a fine sprayer, using tap water. The surface of the soil was frequently stirred. The nonaerated series was made up of an equal number (6) of glazed 4-inch pots with bottoms plugged with paraffined cotton and the tops covered with paraffined paper to reduce aeration. A separatory funnel (shown in Pl. IX, fig. 1) was thrust into each of these pots to admit water for growing the peas, and after inoculating as with the other series the seedlings were introduced through a hole in the paraffined paper. After a month's time the roots of the plants were examined, with the following results:

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[a] Ill. Agr. Exp. Sta. Bul. 94, 1904, Nitrogen Bacteria and Legumes.

[b] Livingston (Bot. Gaz., XLI, 2, 1906, p. 143; see also Bureau of Soils Bul. No. 28) reports a close relation between the growth of roots and tops in wheat, due to a difference of soil, which he explains as follows: "It would seem that the poor soil by inhibiting branch growth and causing the enlargement of cortical cells may render the root system unable to carry on an adequate amount of absorption for normal growth." If this effect upon the cortical cells should be found to hold true with the legumes, it might have a direct bearing upon the ability of the bacteria to penetrate and form nodules. The enlargement of the cortical cell is regarded as a phenomenon of age, and it is reported (Maria Dawson, Phil. Trans. Roy. Soc. London, Ser. B, vol. 192 (1899), p. 24) that infection takes place most readily in quite young radicals.

Aside from the effect of root development upon nodule formation, there is a possible interaction resulting in some way in greater root development where inoculation takes place. In many cases which have come to notice where inoculated plants had shown a superior development of the root system, it seemed at least justifiable to regard the inoculation as assisting in providing the conditions favoring a healthy root growth. In Bulletin No. 237 of the Cornell Agricultural Experiment Station, page 165, it is noted that where no nodules occur the roots of alfalfa are simpler and not so ramifying as where nodules occur.

Treatment.	Nodules on plant No.—						Total.
	1.	2.	3.	4.	5.	6.	
Aerated	4	20	25	8	26	4	87
Nonaerated	0	1	2	0	0	0	3

See Plate VIII, figure 2, noting the difference in the plants in favor of the noduled (aerated) plant.

ASSOCIATIVE ACTION OF BACTERIA.

Undoubtedly the pure cultures of nodule-forming bacteria are subject to contamination when planters, using convenient rather than bacteriological methods, prepare quantities sufficient to inoculate their seed. Yet the purity of a culture immediately before it is applied to seed or introduced into the soil of a cultivated field is unimportant, provided there is present a sufficient number of virile nodule-forming bacteria.

Preliminary experiments at Washington some years ago indicated that in the nitrogen-poor solution generally used the nodule-forming bacteria would develop much more rapidly than other bacteria or contaminating yeasts and molds. It might be expected that different localities would have different contaminating forms, and during the past year samples of cultures have been obtained from farmers in various parts of the United States immediately before the seed or soil was treated. Investigation of contaminating forms isolated from these cultures shows that there are certain forms which inhibit the growth of the nodule organism when both are grown for some time in the usual nitrogen-poor solution.[a] Using an extract of a favorable soil as a culture medium, results very nearly parallel for the competing bacteria were secured, though one organism which resembles *Bacillus coli* checked the growth of *Pseudomonas radicicola* in the synthetic medium and not in the soil extract. The relative virility of the competing cultures at the time they begin their struggle is an exceedingly important factor in determining which species of bacteria survives.

Extended experiments on the interaction of groups of bacteria in various media must be carried on before it will be possible to determine all of the conditions incident to success or failure in legume inoculation.[a] It is safe to assume, however, that the action of a bacterium in the soil is conditioned not only by the chemical and physical characteristics of the soil solution at a particular time, but also, and perhaps essentially, by the biologic conditions obtaining in that soil.

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[a] In view of this fact, the reason for our present method of distribution is apparent. A relatively large amount of pure liquid culture used as a "starter" cuts down the chances of ruining the farmer's culture through the competition of contaminating forms; the time required to fill the solution with the organisms is shortened, and, as shown subsequently, the quicker the bacteria can be introduced into the soil and make use of the soil solution as a culture medium the less becomes the danger from competition.

SUMMARY.

1. Lime is of decided benefit in obtaining successful inoculations of legumes in some soils. These soils often show an acid reaction to litmus.
2. Soil extracts serving as culture media often indicate the probable success of inoculating a leguminous crop. This, however, may not always hold true.
3. At least during the first season's growth no general cross-inoculation takes place. Bacteria from one host may, however, inoculate a physiologically related species.
4. Heavy inoculation by a pure culture increases nodule formation if the soil solution is enriched by the excess of culture medium; however, in a favorable soil a light inoculation well distributed is as effective.
5. Thorough aeration is favorable to nodule formation.
6. Whether in a synthetic medium or a natural soil solution, the functions of a bacterium are influenced by the associative or competitive action of the various groups of organisms with which it comes in contact, as well as by the nature of the culture material.

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[a] See Maria Dawson, Phil. Trans. Roy. Soc. London, Ser. B, vol. 193 (1900), p. 65.

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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 101.

B. T. GALLOWAY, *Chief of Bureau.*

CONTENTS OF AND INDEX TO BULLETINS OF THE BUREAU OF PLANT INDUSTRY NOS. 1 TO 100, INCLUSIVE.

PREPARED BY

J. E. ROCKWELL,
EDITOR OF BUREAU.

ISSUED OCTOBER 12, 1907.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1907.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
OFFICE OF THE CHIEF,
Washington, D. C., August 21, 1907.

SIR: I have the honor to transmit herewith a manuscript entitled "Contents of and Index to Bulletins of the Bureau of Plant Industry Nos. 1 to 100, Inclusive," prepared by Mr. Julius Ensign Rockwell, Editor of this Bureau, and respectfully recommend its publication as Bulletin No. 101 of the Bureau series.

Respectfully,

B. T. GALLOWAY,
Chief of Bureau.

HON. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

Page.

ntroductory statement 7

ist, with contents, of Bulletins of the Bureau of Plant Industry Nos. 1 to 100, inclusive 11

ndex to Bulletins of the Bureau of Plant Industry Nos. 1 to 100, inclusive 41

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CONTENTS OF AND INDEX TO BULLETINS OF THE BUREAU OF PLANT INDUSTRY NOS. 1 TO 100, INCLUSIVE.

INTRODUCTORY STATEMENT.

The work of the Bureau of Plant Industry, which was organized on July 1, 1901, is classified under the general subjects of Pathological Investigations, Physiological Investigations, Taxonomic Investigations, Agronomic Investigations, Horticultural Investigations, and Seed and Plant Introduction Investigations. Upon the organization of the Bureau the several series of bulletins of the various divisions incorporated in the Bureau—Vegetable Pathological and Physiological Investigations, Botanical Investigations and Experiments, Grass and Forage Plant Investigations, Pomological Investigations, and Experimental Gardens and Grounds—were discontinued, and all the scientific and technical publications prepared in these offices and in those subsequently organized have been issued in a single series of bulletins.

Attention is directed to the fact that "the serial, scientific, and technical publications of the United States Department of Agriculture are not for general distribution. All copies not required for official use are by law turned over to the Superintendent of Documents, who is empowered to sell them at cost." All applications for these bulletins should therefore be made to the Superintendent of Documents, Government Printing Office, Washington, D. C., accompanied by either a postal money order, an express money order, a draft on New York, or by cash. Postage stamps, foreign money, uncertified checks, and defaced or slick coin will not be accepted in payment for publications. No charge is made for postage on documents forwarded to points in the United States, Guam, Hawaii, Philippine Islands, Porto Rico, or to Canada, Cuba, or Mexico. To other countries the regular rate of postage is charged, and remittances must cover such postage.

Copies of all of these bulletins except Nos. 5, 16, 21, 23, 26, and 28 can be furnished by the Superintendent of Documents.

Since the publication of the last bulletin indexed in these pages (No. 100), the following bulletins of the Bureau series have appeared or are now in press, as indicated:

No. 101. [The bulletin now in the reader's hands.]
102. Miscellaneous Papers. I. Summary of Recent Investigations of the Value of Cacti as Stock Food. II. A Successful Dairy Farm. III. Planning a Cropping System. IV. The Application of Vegetative Propagation to Leguminous Forage Plants. V. The Control of Texas Root-Rot of Cotton. VI. The History of the Cowpea and Its Introduction into America. VII. A New Method for the Determination of Nicotine in Tobacco. 1907. Price, 15 cents.
103. Dry Farming in the Great Basin. 1907. Price, 10 cents.
104. The Use of Feldspathic Rocks as Fertilizers. 1907. Price, 5 cents.
105. The Relation of the Composition of the Leaf to the Burning Qualities of Tobacco. 1907. Price, 10 cents.
106. Seeds and Plants Imported. Inventory No. 12. [In press.]
107. American Root Drugs. [In press.]
108. The Cold Storage of Small Fruits. 1907. Price, 15 cents.
109. American Varieties of Garden Beans. 1907. Price, 25 cents.
110. Cranberry Diseases. [In press.]
111. Part I. The Larkspurs as Poisonous Plants. 1907. Price, 5 cents. Part II. The Fibers of Long-Staple Upland Cottons. 1907. Price, 5 cents. Part III. Imported Low-Grade Clover and Alfalfa Seed. [In press.]
112. The Use of Suprarenal Glands in the Physiological Testing of Drug Plants. 1907. Price, 10 cents.
113. The Comparative Tolerance of Various Plants for the Salts Common in Alkali Soils. [In press.]
114. Sap-Rot and Other Diseases of the Red Gum. [In press.]
115. The Disinfection of Sewage Effluents for the Protection of Water Supplies. [In press.]
116. The Tuna as Food for Man. [In press.]
117. The Reseeding of Depleted Range and Native Pastures. [In press.]
118. Peruvian Alfalfa. [In press.]

Since its organization the Bureau of Plant Industry has contributed the following papers to the series known as Farmers' Bulletins, copies of which will be sent without cost to any person in the United States or its possessions upon application to a Senator, Representative, or Delegate in Congress, or to the Secretary of Agriculture, Washington, D. C.:

No. 139, Emmer: A Grain for the Semiarid Regions; No. 140, Pineapple Growing; No. 147, Winter Forage Crops for the South; No. 148, Celery Culture; No. 154, The Home Fruit Garden: Preparation and Care; No. 156, The Home Vineyard, with Special Reference to Northern Conditions; No. 157, The Propagation of Plants; No. 161, Practical Suggestions for Fruit Growers; No. 164, Rape as a Forage Crop; No. 167, Cassava; No. 168, Pearl Millet; No. 174, Broom Corn; No. 175, Home Manufacture and Use of Unfermented Grape Juice; No. 176, Cranberry Culture; No. 181, Pruning; No. 185, Beautifying the Home Grounds; No. 188, Weeds Used in Medicine; No. 194, Alfalfa Seed; No. 195, Annual Flowering Plants; No. 198, Strawberries; No. 199, Corn

Growing; No. 204, The Cultivation of Mushrooms; No. 208, Varieties of Fruits Recommended for Planting; No. 213, Raspberries; No. 214, Beneficial Bacteria for Leguminous Crops; No. 215, Alfalfa Growing; [a]No. 217, Essential Steps in Securing an Early Crop of Cotton; No. 218, The School Garden; No. 219, Lessons from the Grain-Rust Epidemic of 1904; No. 220, Tomatoes; No. 221, Fungous Diseases of the Cranberry; No. 224, Canadian Field Peas; No. 229, The Production of Good Seed Corn; No. 231, Spraying for Cucumber and Melon Diseases; No. 232, Okra: Its Culture and Uses; No. 238, Citrus Fruit Growing in the Gulf States; No. 240, Inoculation of Legumes; No. 242, An Example of Model Farming; No. 243, Fungicides and Their Use in Preventing Diseases of Fruits; No. 245, Renovation of Worn-Out Soils; No. 246, Saccharine Sorghums for Forage; [a]No. 247, The Control of the Codling Moth and Apple Scab; No. 248, The Lawn; No. 250, The Prevention of Stinking Smut of Wheat and Loose Smut of Oats; No. 253, The Germination of Seed Corn; No. 254, Cucumbers; No. 255, The Home Vegetable Garden; No. 260, Seed of Red Clover and Its Impurities; No. 271, Forage-Crop Practices in Western Oregon and Western Washington; No. 272, A Successful Hog and Seed Corn Farm; No. 274, Flax Culture; No. 278, Leguminous Crops for Green Manuring; No. 279, A Method of Eradicating Johnson Grass; No. 280, A Profitable Tenant Dairy Farm; No. 282, Celery; [a]No. 283, Spraying for Apple Diseases and the Codling Moth in the Ozarks; [a]No. 284, Insect and Fungous Enemies of the Grape East of the Rocky Mountains; No. 285, The Advantage of Planting Heavy Cotton Seed; No. 286, Comparative Value of Whole Cotton Seed and Cotton-Seed Meal in Fertilizing Cotton; No. 288, Nonsaccharine Sorghums; No. 289, Beans; No. 291, Evaporation of Apples; No. 292, Cost of Filling Silos; No. 294, Farm Practice in the Columbia Basin Uplands; No. 299, Diversified Farmng Under the Plantation System; No. 300, Some Important Grasses for the Gulf Coast Region; No. 301, Home-Grown Tea; No. 302, Sea Island Cotton; No. 304, Growing and Curing Hops; No. 306, Dodder in Relation to Farm Seeds; No. 307, Roselle: Its Culture and Uses.

In addition, the Bureau of Plant Industry has contributed the ollowing papers to the Yearbooks of the Department of Agriculure from 1901 to date, all of which have been reprinted for distribution in separate form. The editions of those bearing numbers marked with a star (*) are exhausted. The others can be obtained without cost upon addressing a request therefor to the Secretary of Agriculture, Washington, D. C.

No. 225, The Relation of Nutrition to the Health of Plants; No. 229, Little-Known Fruit Varieties Considered Worthy of Wider Dissemination; *No. 230, ommercial Apple Orcharding; *No. 238, Agricultural Seeds—Where Grown nd How Handled; *No. 242, Agriculture in the Tropical Islands of the United tates; No. 246, The Home Fruit Garden; No. 254, The Hemp Industry in the United States; No. 262, The Contamination of Public Water Supplies by Algæ; No. 264, Industrial Progress in Plant Work; *No. 266, Top-Working Orchard Trees; *No. 277, Bacteria and the Nitrogen Problem; No. 278, Systems of Farm Management in the United States; No. 279, Improvement of Cotton by eed Selection; No. 281, Grape, Raisin, and Wine Production in the United tates; No. 283, Promising New Fruits; No. 284, Plants as a Factor in Home Adornment; No. 287, Improvement of Corn by Seed Selection; No. 290, Ferti-

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[a] Contributed jointly by the Bureaus of Entomology and Plant Industry.

lizers for Special Crops; No. 291, Crops Used in the Reclamation of Alkali Lands in Egypt; *No. 293, Cultivation and Fertilization of Peach Orchards; *No. 310, The Cultivation of Corn; No. 314, The Growing of Long-Staple Upland Cotton; No. 317, Relation of Cold Storage to Commercial Apple Culture; No. 320, Relation of Sugar Beets to General Farming; No. 321, Principal Commercial Plant Fibers; *No. 323, A Model Farm; No. 325, Cultivation of Drug Plants in the United States; No. 326, Macaroni Wheat; No. 330, Promising New Fruits; No. 336, The Relation of Plant Physiology to the Development of Agriculture; No. 340, Opportunities in Agriculture: I. Growing Crops under Glass. II. Fruit Growing. III. General Farming; *No. 343, New Citrus Creations of the Department of Agriculture; *No. 349, Potato Culture near Greeley, Colorado; No. 351, Sugar-Beet Seed Breeding; No. 354, Some Uses of the Grapevine and Its Fruit; No. 356, Promising New Fruits; No. 358, The Improvement of Tobacco by Breeding and Selection; No. 361, Cotton Culture in Guatemala; *No. 363, Work of the Bureau of Plant Industry in Meeting the Ravages of the Boll Weevil and Some Diseases of Cotton; No. 367, Plant Diseases in 1904; No. 377, Diversified Farming in the Cotton Belt: I. South Atlantic Coast. II. Alabama and Mississippi. III. Louisiana, Arkansas, and Northeastern Texas. IV. Texas; No. 383, New Fruit Production of the Department of Agriculture; *No. 384, The Business of Seed and Plant Introduction and Distribution; No. 387, The Handling of Fruit for Transportation; No. 389, The Effect of Inbreeding in Plants; * No. 394, New Opportunities in Subtropical Fruit Growing; No. 399, Promising New Fruits; No. 401, Progress in Drug-Plant Cultivation; No. 409, Plant Diseases in 1905; No. 411, The Present Status of the Nitrogen Problem; No. 419, Range Management; No. 422, Methods of Reducing the Cost of Producing Beet Sugar; No. 427, New Citrus and Pineapple Productions of the Department of Agriculture; No. 429, Promising New Fruits; No. 431, New Tobacco Varieties; No. 437, Plant Diseases in 1906.

A report of the Chief of the Bureau of Plant Industry detailing the principal lines of investigation undertaken and the results accomplished during the preceding twelve months has been issued yearly both in connection with the Annual Report of the Secretary of Agriculture and in separate form.

The miscellaneous circulars and minor publications of the Bureau, referring to many different lines of work and appearing in various forms, do not bear consecutive numbers or constitute a regular series, and on account of limited editions not being available for distribution even to public libraries, agricultural experiment stations, or to collaborators of the Department of Agriculture, they are not classed as "publications" and no announcement of their issue from the press is made by the Department.

J. E. Rockwell,
Editor of Bureau.

Washington, D. C.,
August 20, 1907.

LIST, WITH CONTENTS, OF BULLETINS OF THE BUREAU OF PLANT INDUSTRY NOS. 1 TO 100, INCLUSIVE.

A star (*) before a number indicates that the stock of the Department of Agriculture is exhausted and that collaborators can not be supplied with the bulletin so marked. Similarly, a star before a part of a bulletin shows that this part can not be furnished in separate form. Where a dagger (†) is used, the electrotype plates of the bulletin specified have been destroyed. Where no price is given (in the cases of Bulletins Nos. 5, 16, 21, 23, 26, and 28), the publication can not be furnished by the Superintendent of Documents.

* No. 1. The Relation of Lime and Magnesia to Plant Growth. I. Liming of Soils from a Physiological Standpoint. By Oscar Loew, Expert in Physiological Chemistry. II. Experimental Study of the Relation of Lime and Magnesia to Plant Growth. By D. W. May, of the Office of Experiment Stations. 1901. 53 pp., 3 pls. Price, 10 cents.

CONTENTS: I. Liming of soils from a physiological standpoint: Introduction—Injurious action of magnesium salts—Theoretical discussion of the functions of lime and magnesia—The ratio between lime and magnesia in soils of different countries: Soils of America; soils from European countries; soils from Asiatic countries; soils from African countries; soils from Australia; river deposits—Some special physiological cases relating to the ratio between lime and magnesia—Correction of lime and magnesia content in soils. II. Experimental study of the relation of lime and magnesia to plant growth: Introduction—The rôle of lime in the soil—The rôle of magnesia in the soil—The object of the experiments—Lime and magnesia as nitrates and sulphates in water cultures: Results of experiments with cowpeas; results of experiments with privet—Lime and magnesia as carbonates in sand cultures: Experiments with tobacco; experiments with barley; experiments with oats, wheat, and beans—Lime and magnesia as carbonates in soil cultures: Experiments with oats and cowpeas—Lime and magnesia as nitrates in sand cultures: Experiments with wheat and oats; experiments with cowpeas; experiments with tobacco—Lime as sulphate and magnesia as carbonate in soil cultures: Experiments with cowpeas—Summary.

* † No. 2. Spermatogenesis and Fecundation of Zamia. By Herbert J. Webber, Physiologist, Vegetable Pathological and Physiological Investigations, Plant-Breeding Laboratory. 1901. 100 pp., 7 pls. Price, 20 cents.

CONTENTS: Introduction: Summary of recent literature; acknowledgments—Methods and materials used—Development of microspores—Development of pistillate cones—Development of the pollen tube and prothallus: Germination of pollen and growth of prothallus; division of second prothallial cell; appearance and growth of blepharoplasts; growth of basal end of pollen tube—Division of the central cell—Metamorphosis of the spermatids—Structure and form of the mature spermatozoid—Movement of spermatozoids—Process of fecundation—Division of the fecundated egg cell—Is the blepharoplast a centrosome?—Summary—Bibliography—Explanation of illustrations.

No. 3. Macaroni Wheats. By Mark Alfred Carleton, Cerealist, Vegetable Pathological and Physiological Investigations. 1901. 62 pp., 11 pls., 2 figs. Price, 20 cents.

CONTENTS: Introduction—Characteristics of macaroni wheats—Distribution of macaroni wheats—Adaptability of durum wheats to our semiarid districts: Climatic comparisons; comparison of soils; experimental proof; testimony of private parties; testimony of experiment stations—The market for macaroni wheat: Foreign demand; quality of grain demanded; possibility of a home demand; kinds of wheat now used by our factories; comparison of foreign and domestic macaroni; preparation of semolina; bread from macaroni wheats—Cultivation of macaroni wheats: Preparation of the soil; methods of seeding; care in harvesting—Effects of local variations in soil and climate—Varieties: Gharnovka; Arnautka; Kubanka; Pererodka; Beloturka; Velvet Don; Black Don; Sarui-bugda; Medeah; Pellissier; Candeal; Nicaragua; Wild Goose; Missogen; Polish; winter varieties—Experimental comparison of varieties—Russo-Mediterranean traffic in macaroni wheat—Summary.

† No. 4. Range Improvement in Arizona. (Cooperative Experiments with the Arizona Experiment Station.) By David Griffiths, Expert in Charge of Field Management, Grass and Forage Plant Investigations. 1901. 31 pp., 6 pls., 5 figs. Price, 10 cents.

CONTENTS: Introduction—Former conditions—Circular letter and questions—Answers to questions—Feed on the range: The plantains; saltbushes and their allies; native legumes; the Cactaceæ; the grasses—The range reserve tract: Area C; area E; area F; area A; area B; area D—Precipitation records—Summary and suggestions.

*† No. 5. Seeds and Plants Imported through the Section of Seed and Plant Introduction for Distribution in Cooperation with the Agricultural Experiment Stations. Inventory No. 9, Numbers 4351–5500. 1902. 79 pp.

CONTENTS: Introductory statement—Inventory of seeds and plants imported—Index of common and scientific names.

† No. 6. A List of American Varieties of Peppers. By W. W. Tracy, jr., Assistant, Botanical Investigations and Experiments. 1902. 19 pp. Price, 10 cents.

CONTENTS: Introduction—List of abbreviations of names of seedsmen—List of varieties.

* No. 7. The Algerian Durum Wheats: A Classified List, with Descriptions. By Carl S. Scofield, Expert, Botanical Investigations and Experiments. 1902. 48 pp., 18 pls. Price, 15 cents.

CONTENTS: Introduction—Object of a descriptive classification of wheat varieties—Basis of present descriptions and classification: Structure of the wheat head; grain characters; relative value of characters—Glossary of terms used—General character of the durum wheats—Description of varieties with key: Aicha el Beida; Courtellement; Beloturka; Xeres; Poulot; Paros; Beliouni; Medeah; Caid de Siouf; Kahla; Trimenia; Hached; Boghar; El Aoudja; Tesdouni; M'Saken; Medeba; Meskiana; Caid Eleuze; Pelissier; Mohamed ben Bachir; El Hamra; Azizi; Maroc; Ouchda; Adjini; Zedouni; Aures; Moroccain; Nab el Bel; El Safra.

*† No. 8. A Collection of Economic and Other Fungi Prepared for Distribution. By Flora W. Patterson, Mycologist, Vegetable Pathological and Physiological Investigations. 1902. 31 pp. Price, 10 cents.

Contents: Introduction—List of duplicate material prepared for free distribution and for exchange to the State Agricultural Experiment Stations and to persons interested in work upon fungi.

* No. 9. The North American Species of Spartina. By Elmer D. Merrill, Assistant Agrostologist, Grass and Forage Plant Investigations. 1902. 16 pp. Price, 10 cents.

Contents: Technical descriptions of the grasses included in the genus Spartina.

† No. 10. Records of Seed Distribution and Cooperative Experiments with Grasses and Forage Plants. By F. Lamson-Scribner, Agrostologist, Grass and Forage Plant Investigations. 1902. 23 pp. Price, 10 cents.

Contents: Purchase and collection of seeds, roots, and specimens—Cooperation with the stations authorized—Lines of investigations of forage problems—Articles of cooperation—Seed distribution: Distribution by packages; distribution by pounds; amounts of the several varieties distributed—Seeds to private individuals—System of keeping records—A list of experiment stations with which articles of cooperation have been signed—Conclusion.

* No. 11. Johnson Grass: Report of Investigations made during the Season of 1901. By Carleton R. Ball, Assistant Agrostologist, Grass and Forage Plant Investigations. 1902. 24 pp., 1 pl., 1 fig. Price, 10 cents.

Contents: Description—Origin and distribution—Dissemination—Control: State laws—Eradication: Hand labor; cultivation; winter fallow; summer fallow; cultivation in crops; patented methods; use of chemicals; electricity—Utilization of Johnson grass—Summary.

* † No. 12. Stock Ranges of Northwestern California: Notes on the Grasses and Forage Plants and Range Conditions. By Joseph Burtt Davy, Assistant Botanist, Agricultural Experiment Station, University of California. 1902. 81 pp., 8 pls., 3 maps, 4 figs. Price, 15 cents.

Contents: Introduction—Physical features of the region: Agricultural subdivisions; topography; climatology; temperature; precipitation; prevailing winds—Itinerary—Range conditions: The interior plateau region; mountain valleys; temperature; water supply; soils; agricultural products; the wild meadows and pastures; forage value of the wild meadows; improvement of pasture and meadow; forage plants recommended for trial; the upland ranges; temperature; precipitation; water supply; soils; the open, summer, or annual range; grasses and other forage plants; weeds; the prairies; the woodland or winter range; trees; underbrush; herbaceous plants; forage plants; improvement of the woodland forage; forage plants recommended for trial; the chaparral; subalpine meadows; system of range rotation and management; carrying capacity; present capacity; former capacity; range deterioration; primary cause; excessive land valuations; how overstocking effects deterioration; wild oats and alfilerilla; bunch-grasses; sheep versus cattle; summary; range preservation; formation of a seed bed; preserve the timber and brush; maximum versus optimum stocking; range renewal; range improvement—The coast-bluff belt: Climatology; the mesa lands; soils; grasses and other forage plants; the white-ash prairies; bottom lands; soils; forage crops; land values; sand dunes; native sand binders; methods of preventing drifting and reclamation of waste dunes; beach grass; sea lyme grass; utilization of sand dunes—The redwood belt—Fodder crops: Fodder crops now cultivated; plants recommended for cultivation or trial—Poisonous plants—Fungous parasites—Phytographic notes—Summary—Index.

* † No. 13. Experiments in Range Improvement in Central Texas. By H. L. Bentley, Special Agent, Grass and Forage Plant Investigations. 1902. 72 pp., 2 pls., 6 figs. Price, 10 cents.

CONTENTS: Introduction—History of the first year's work: Selection of the land; plan of experiments; carrying capacity of the pastures; seeding the ground; conclusions from the first year's work—History of the second year's work: Experiments with varieties; range improvement; catching wind-blown seeds; transplanting grass roots; baling legumes and fodder plants; exhibits at fairs; summary—History of the third year's work: Weather conditions; grass-garden work; a failure noted; a tentative success noted; experiments with grasses; native grasses the best; experiments with the coarser forage plants; range improvement; transplanting grass roots; the cultivation of pasture grasses—Summary: Cattle held on station pastures; the matter of cost—Hay and pasture plants recommended for central Texas: Grasses; barnyard grass; Bermuda grass; buffalo grass; bushy blue stem; Colorado grass; cotton top grass; crab grass; curly mesquite; everlasting grass; gama grass; grama grasses; black grama; blue grama; side oats grama; Johnson grass; knot grass; little blue stem; the millets; needle grass; rescue grass; the sedges; smooth brome grass; the sorghums; Texas blue grass; white top grass; wild rye; wild timothy; other central Texas grasses; legumes in central Texas; alfalfa or lucern; Turkestan alfalfa; oasis alfalfa; Florida beggarweed; the clovers; alsike clover; bur clover; mammoth clover; red clover; Russian red clover; sweet clover; white clover; peas and beans; cowpea; field pea; gram or chick pea; Metcalf bean; soy bean; sulla; velvet bean; vetches; spring vetch; hairy vetch; other forage plants; common oats and wheat; peanuts; rape; saltbushes; sanfoin; sweet potato; tallow weed; teosinte—Conclusion.

* No. 14. The Decay of Timber and Methods of Preventing It. By Hermann von Schrenk, Instructor in Henry Shaw School of Botany and Special Agent in Charge of Mississippi Valley Laboratory, Vegetable Pathological and Physiological Investigations. 1902. 96 pp., 18 pls., 27 figs. Price, 55 cents.

CONTENTS: Introduction: Scope of this report—Structure of timber: Wood cells, wood fibers, etc.; chemical nature of wood; mechanical nature of wood; life of the wood cells; heart and sap wood—Factors which cause the decay of wood: General remarks; agents which cause decay; how fungi and bacteria grow; rate of growth and decay; natural resistance of timber; sawn versus hewn timber; seasoned versus green timber; races of wood; variability in timber; summary—Timber preservation: Introduction; theory of impregnation; retrogressive changes which take place in impregnated wood—Results of timber impregnation: Introduction; experiment made in Texas—Results of timber impregnation in Europe—Ties, poles, etc.: Kinds of timber; form; tie specifications; splitting; stacking; summary—Ballast—Tie plates—Fastening—Methods of impregnation: Introduction; effect of seasoning after treatment; results of treatment; conclusions; creosoting; summary; zinc chloride and coal-tar oil; Hasselmann treatment; new processes; the senilization process; emulsion treatment; creo-resinate process; Ferrel process; conclusions—Removal and disposal of ties—Records—Conclusions and recommendations: Seasoning of timber; sawn and hewn timber; form of tie; preservative processes; changes which treated timber undergoes; utilization of inferior timbers; the growing of tie timber; causes of decay of timber—Bibliography—Appendix.

* † No. 15. Forage Conditions on the Northern Border of the Great Basin, Being a Report upon Investigations Made during July and August, 1901, in the Region between Winnemucca, Nevada, and Ontario, Oregon. By David Griffiths, Expert in Charge of Field Management, Grass and Forage Plant Investigations. 1902. 60 pp., 16 pls., 1 map. Price, 15 cents.

CONTENTS: Introduction—Description of the region: Precipitation record for 1900 and 1901—The soils: Description of soil samples; partial analyses of soil samples; forage plants growing on alkaline soils—Handling of stock—The range: Range conditions—Hay crops: Methods of handling hay—Sand binders—Weeds—Poisonous plants—Forage plants: The true sages; the salt sages and their allies; the clovers; the sedges and rushes; miscellaneous; the grasses—Summary—Index of common and scientific names.

* † No. 16. A Preliminary Study of the Germination of the Spores of Agaricus Campestris and Other Basidiomycetous Fungi. By Margaret C. Ferguson, cooperating with Vegetable Pathological and Physiological Investigations. 1902. 43 pp., 3 pls.

CONTENTS: Introduction—Methods—Experimental: Spore germination (preliminary study); extremes of temperature; action of an artificial digestive fluid; effect of acids on germination; acids followed by alkalies; effect of light on germination; age of the spores relative to their power of germination; a new factor in germination; effect of mycelium on germination; a list of substances tested—Conditions of growth: Coprinus micaceus; Hypholoma appendiculatum; Agaricus campestris—Historical—Bibliography—Appendix.

No. 17. Some Diseases of the Cowpea. I. The Wilt Disease of the Cowpea and Its Control. By W. A. Orton, Assistant Pathologist. II. A Cowpea Resistant to Root-Knot (Heterodera Radicicola). By Herbert J. Webber, Physiologist, and W. A. Orton, Assistant Pathologist. 1902. 38 pp., 6 pls., 1 fig. Price, 10 cents.

CONTENTS: I. The wilt disease of the cowpea and its control: Introduction—Description of the disease—Cause of the disease: Description of the fungus; manner of infection and spread; relation to other wilt diseases—Distribution—Extent of loss—Preventive measures: Rotation of crops; substitution of other crops; experiments with cowpeas and other crops. II. A cowpea resistant to root-knot (Heterodera radicicola): Introduction—Description of the disease—Plants affected—Extent of the disease—Methods of treating root-knot—The use of resistant varieties and stocks—A resistant cowpea—The breeding of nematode-resistant plants.

* † No. 18. Observations on the Mosaic Disease of Tobacco. By Albert F. Woods, Pathologist and Physiologist, Vegetable Pathological and Physiological Investigations. 1902. 24 pp., 6 pls. (including 3 in colors). Price, 15 cents.

CONTENTS: Introduction and historical summary—Translocation of starch—Artificial production of the disease—Infectious nature of the disease—Zymogen for oxidase and peroxidase—Preventive measures.

* No. 19. Kentucky Bluegrass Seed: Harvesting, Curing, and Cleaning. By A. J. Pieters, Botanist in Charge of Seed Laboratory, and Edgar Brown, Assistant Botanist, Botanical Investigations and Experiments. 1902. 19 pp., 6 pls., 3 figs. Price, 10 cents.

CONTENTS: Introduction—Distribution of Kentucky bluegrass—Quality of seed required by the foreign trade—Adulteration—Source of the market supply—Factors controlling the profitable harvesting of seed—Yield per acre and total crop—Harvesting: Season; harvesting green seed; methods; kinds of strippers—Curing: Present methods; turning the ricks; heating; relative merits of indoor and outdoor curing—Cleaning—Effect of curing on the vitality of the seed: Germination tests; summary of results—Artificial curing—Conclusions.

No. 20. Manufacture of Semolina and Macaroni. By Robert P. Skinner, Consul General at Marseille. 1902. 31 pp., 5 pls., 6 figs. Price, 15 cents.

CONTENTS: Introduction: A neglected opportunity; development of the industry in France; French metadiné wheats; growth of the demand for macaroni; need of growing the durum wheat—The market for durum wheat: Wild Goose wheat; prospective demand for American hard wheat and semolina; European methods and products; scouring the grain—Manufacture of semolina: Using wheat from different countries; cleaning the wheat; percentage of semolina in different wheats; importance of cleanliness; the milling process; classification of products—Manufacture of macaroni: The process; mixing the semolina; curing operations—Durum wheat for bread flour—Tables of exports, imports, and prices.

* No. 21. List of American Varieties of Vegetables for the Years 1901 and 1902. By W. W. Tracy, jr., Assistant, Botanical Investigations and Experiments. 1903. 402 pp.

CONTENTS: Introduction—Rules of nomenclature—Rules for entering—List of abbreviations of names of seedsmen—List of varieties: Artichoke; asparagus; bush lima bean; green-podded bush bean; pole bean; pole lima bean; wax-podded bush bean; garden beet; sugar beet and mangel-wurzel; broccoli; Brussels sprouts; burnet; cabbage; cardoon; carrot; cauliflower; celeriac; celery; chervil; chicory; chives; chufas; collards; field corn; pop corn; sweet corn; corn salad; cress; cucumber; dandelion; eggplant; endive; fetticus; flag; French spinach; garlic; German celery; grass nuts; gumbo; herbs; horse-radish; kale; kohl-rabi; leek; lettuce; martynia; melon; muskmelon; mustard; okra; onion; orach; oyster plant; parsley; parsnip; pea; peanut; pepper; pieplant; pumpkin; radish; rampion; rhubarb; roquette; salsify; scolymus; scorzonera; skirret; sorrel; spinach; squash; sunflower; Swiss chard; tomato; garden turnip; ruta-baga; watermelon.

† No. 22. Injurious Effects of Premature Pollination; with General Notes on Artificial Pollination and the Setting of Fruit without Pollination. By Charles P. Hartley, Assistant in Physiology, Plant Breeding Laboratory, Vegetable Pathological and Physiological Investigations. 1902. 48 pp., 4 pls., 1 fig. Price, 10 cents.

CONTENTS: Introduction—Experiments with tobacco blossoms: Microscopic study of tobacco pistils and ovaries—Experiments with blossoms of Datura tatula—Experiments with cotton blossoms—Experiments with orange blossoms—Experiments with tomato blossoms—Conclusion—Explanation of plates.

* No. 23. Berseem: The Great Forage and Soiling Crop of the Nile Valley. By David G. Fairchild, Agricultural Explorer for Seed and Plant Introduction. 1902. 20 pp., 14 pls.

CONTENTS: Introduction—General uses—Varieties: Muscowi; Fachl; Saida—Use as a green fodder—Berseem as a hay crop—Conclusion—Description of plates.

No. 24. The Manufacture and Preservation of Unfermented Grape Must. By George C. Husmann, Expert in Charge of Viticultural Investigations, Pomological Investigations. 1902. 19 pp., 1 pl., 4 figs. Price, 10 cents.

CONTENTS: Introduction—Historical notes—Composition of the grape—Causes of fermentation—Methods of preventing fermentation—Process used in California—Methods used in the Eastern States—Home manufacture—Uses of unfermented must—A few good recipes—Analyses of grape must—Prices and statistics.

No. 25. Miscellaneous Papers. I. The Seeds of Rescue Grass and Chess. By F. H. Hillman, Assistant, Seed Laboratory. II. Saragolla Wheat. By David G. Fairchild, Agricultural Explorer. III. Plant Introduction Notes from South Africa. By David G. Fairchild, Agricultural Explorer. IV. Congressional Seed and Plant Distribution Circulars, 1902–1903. 1903. 82 pp., 3 pls., 6 figs. Price, 15 cents.

CONTENTS: The seeds of rescue grass and chess. Saragolla wheat. Plant introduction notes from South Africa: Introduction—Some Cape seedling grape varieties: The Red Hanepoot grape; Vitis rupestris metallica; Vitis rupestris Le Roux—Fruit-bearing hedge plants—Rhodes grass—The Kafir plum as a shade tree—The Rooibloem, a new corn parasite—The Natal pineapple. Congressional Seed and Plant Distribution circulars, 1902–1903: Plan of distribution and allotments—Distribution of novelties and specialties—Directions for planting bulbs—Distribution of cotton seed—Rivers Sea Island cotton—Sea Island cotton No. 224—Iron cowpea—Kleinwanzleben sugar beet—Distribution of tobacco seed and cultural directions.

* No. 26. Spanish Almonds and Their Introduction into America. By David G. Fairchild, Agricultural Explorer, Seed Introduction and Distribution. 1902. 16 pp., frontispiece, 7 pls.

CONTENTS: Introduction—The almond industry in Spain: Varieties of Spanish almonds; method of planting and culture; gummosis of the almond—Possibility of establishing the Jordan almond in America—Description of plates.

No. 27. Letters on Agriculture in the West Indies, Spain, and the Orient. By David G. Fairchild, Agricultural Explorer, Seed and Plant Introduction and Distribution. 1902. 40 pp., 5 pls. Price, 15 cents.

CONTENTS: Agriculture in the British West Indies—Jamaica yam cultivation—Opportunities for agricultural and botanical research in the Philippine Islands—Agricultural conditions in Spain—Notes on conditions in China—The Persian Gulf region—Breeds of milch cattle and carabaos for the Philippine Islands—Agriculture in Japan—Description of plates.

* No. 28. The Mango in Porto Rico. By G. N. Collins, Assistant Botanist in Tropical Agriculture, Botanical Investigations and Experiments. 1903. 38 pp., 15 pls.

CONTENTS: Introduction — Description — Origin — Culture: Requirements; methods of propagation; seed; inarching; layering; patch budding; cultivation; diseases—Uses: The canning of the green or ripe fruit; marmalade and jelly; chutney; alcohol; medicinal properties; dye, tan, and pigment; gum; minor uses in India—The mango in Porto Rico: Present status; best localities; Porto Rican forms; Mango de Mayaguez; Mangotina; Melocoton; Mango de rosa; Mango piña; Mango largo; Mango mangó; Mango jobos; Mango redondo; varieties to be introduced; Mulgoba: Alphonse, Aphoos, or Alfoos; No. 11; Manila; Mango china; Gordon; Peters; Julie; best method of introducing new varieties—Packing and shipping—Market—Summary—Description of plates.

† No. 29. The Effect of Black-Rot on Turnips: A Series of Photomicrographs, Accompanied by an Explanatory Text. By Erwin F. Smith, Pathologist, Laboratory of Plant Pathology, Vegetable Pathological and Physiological Investigations. 1903. 20 pp., frontispiece, 13 pls. Price, 15 cents.

CONTENTS: Introductory—General considerations—Plant furnishing the cultures—The method of inoculation, etc.—Symptoms which resulted—Technique employed in study of diseased plant—Special account of the diseased plant—Results of synchronous inoculations into other plants—Description of plates.

* No. 30. Budding the Pecan. By George W. Oliver, Expert, Seed and Plant Introduction and Distribution. 1902. 20 pp., frontispiece, 7 pls. Price, 10 cents.

CONTENTS: Difficulties encountered in pecan budding—Why the pecan should be budded—Raising seedling stocks—Selection of dormant buds—Location of the buds—Experiments with buds of the current season—An improved method of budding—Other methods of budding—Starting buds into growth—Transplanting budded trees—Description of plates.

No. 31. Cultivated Forage Crops of the Northwestern States. By A. S. Hitchcock, Assistant Agrostologist, in Charge of Cooperative Experiments, Grass and Forage Plant Investigations. 1902. 28 pp., 7 pls. Price, 10 cents.

CONTENTS: Description of the regions: Great Plains; Rocky Mountain region; Great Basin; interior valley of California; upper Pacific coast region; the "Inland Empire"—Forage crops: Alfalfa; general conditions; feeding value; seeding; making hay; Turkestan alfalfa; timothy; grain hay; redtop; awnless brome grass; velvet grass; clovers; forage crops of minor importance; Kentucky bluegrass; orchard grass; cheat; perennial rye grass; rape; field peas; vetches—Baling hay—Description of plates.

* No. 32. A Disease of the White Ash Caused by Polyporus Fraxinophilus. By Hermann von Schrenk, Special Agent in Charge of the Mississippi Valley Laboratory, Vegetable Pathological and Physiological Investigations. 1903. 20 pp., 5 pls., 1 fig. Price, 10 cents.

CONTENTS: Introduction—White rot: Geographical distribution; susceptibility to this disease; method of attack; description of diseased wood; the sporophore; microscopic changes in the wood; growth of the fungus in dead wood; remedies—Description of plates.

* No. 33. North American Species of Leptochloa. By A. S. Hitchcock, Assistant Agrostologist, in Charge of Cooperative Experiments, Grass and Forage Plant Investigations. 1903. 24 pp., 6 pls., 16 figs. Price, 15 cents.

CONTENTS: Introduction—Key to species of the United States—History of genus—North American species—Species excluded—Description of plates.

* † No. 34. Silkworm Food Plants: Cultivation and Propagation. By George W. Oliver, Expert, Seed and Plant Introduction and Distribution. 1903. 20 pp., frontispiece, 12 pls. Price, 15 cents.

CONTENTS: Introduction—Methods of reproduction: Propagation by cuttings; summer cuttings; winter cuttings; the cutting; preparations for planting cuttings; indoor spring cuttings; propagation by seeds; grafting and budding; root grafting; scion or sprig budding; shield budding; raising stocks for grafting and budding—Soil—Planting—Pruning—Description of plates.

No. 35. Recent Foreign Explorations, as Bearing on the Agricultural Development of the Southern States. By S. A. Knapp, Special Agent, Seed and Plant Introduction and Distribution. 1903. 44 pp., 6 pls., 2 figs. Price, 15 cents.

CONTENTS: Introduction—Japan: Agricultural situation; acreage and yield of food crops; methods of rice culture; field work; cutting rice; manure; farm wages; cost of raising rice; farm life; general remarks—Ceylon: Agriculture; imports; farmhouses—India: Timber; extent of arable land; fertility of the soil; green manures; commercial fertilizers; crop rotation; public roads; conveyances; dress; country houses; villages; plows and scrapers; seeding and harvesting; rice farming; treatment of the seed bed and manuring; plowing and fertilizing; methods of cultivation; product per acre; harvesting; thrashing; wages; cost of cultivation; northern limit of culture; consumption of rice as food; acreage under cultivation; acreage under irrigation; live stock and farm implements; wells; rice produced; agriculture in the Punjab; cost of living; rice farming in Lower Burma; rice milling; rice for foreign markets; selection of seeds—China: Agricultural conditions; tillage of the soil; irrigation; cultivating, harvesting, and thrashing rice; hulling rice; production and cost of milling rice; cost of building, etc.; exportation of agricultural products—The Philippine Islands: Rainfall; temperature; range of products; stock and pasture lands; fodder plants; sugar cane; rice farming; fruits; timber.

* No. 36. The "Bluing" and the "Red-Rot" of the Western Yellow Pine, with Special Reference to the Black Hills Forest Reserve. By Hermann von Schrenk, Special Agent in Charge of the Mississippi Valley Laboratory, Vegetable Pathological and Physiological Investigations. 1903. 40 pp., 14 pls. (including 4 in colors). Price, 30 cents.

CONTENTS: Introduction—Death of the trees: When are the trees dead—The "blue" wood: Rate of growth of the blue color; nature of the "blue" wood; strength of the "blue" timber; lasting power of the "blue" wood—The "blue" fungus: Effect of "blue" fungus on the toughness of the "blue" wood; relation of the "blue" fungus infection to the beetle holes; fruiting organs of the "blue" fungus; growth in artificial media; dissemination of the spores; the blue color; summary—Decay of the "blue" wood: The "red-rot" of the western yellow pine: cause of the "red-rot"; conditions favoring the development of the "red-rot" fungus; final stages and fruiting organs; rate of growth of "red-rot"—Amount of diseased timber—Possible disposal of the dead wood: In the Black Hills; in the remaining parts of South Dakota—Value of the dead wood—Inspection—Recommendations—Description of plates.

No. 37. Formation of the Spores in the Sporangia of Rhizopus Nigricans and of Phycomyces Nitens. By Deane B. Swingle, Assistant in Pathology, Laboratory of Plant Pathology. 1903. 40 pp., 6 pls. Price, 15 cents.

CONTENTS: Historical—Methods—Rhizopus nigricans Ehrbg.—Phycomyces nitens Kunze—General considerations—Summary—Index to literature—Description of plates.

*** No. 38. Forage Conditions and Problems in Eastern Washington, Eastern Oregon, Northeastern California, and Northwestern Nevada. By David Griffiths, Assistant in Charge of Range Investigations. 1903. 52 pp., 9 pls. Price, 15 cents.**

CONTENTS: Introduction—Itinerary—General account—Changes in the handling of the Washington ranges—Condition and plants of the range—Meadows and hay crops: Alfalfa; timothy and redtop; awnless brome; grain hay; cheat; root crops; native hay crops; wild wheat; bunch bluegrass; giant rye-grass; sprangle-top; miscellaneous forage plants—Reclamation of swamp lands—Needs of the region—Plants injurious to stock—Weeds of meadows and pastures—Diseases injurious to forage crops: Ustilago hypodites; Ustilago scolochloa; Tilletia fusca; Ustilago bromivora; Ustilago striaeformis—Summary and suggestions: Needs of the region; abuses; native grasses worthy of cultivation; wild wheat (Elymus triticoides); bunch bluegrass (Poa laevigata); short-awned brome (Bromus marginatus); mountain rye-grass (Elymus glaucus); bunch wheat-grass (Agropyron spicatum inerme); giant rye-grass (Elymus condensatus)—Index of grasses and forage plants—Description of plates.

*** No. 39. The Propagation of the Easter Lily from Seed. By George W. Oliver, Expert, Seed and Plant Introduction and Distribution. 1903. 24 pp., 7 pls. Price, 10 cents.**

CONTENTS: The Bermuda lily—Varieties of Lilium longiflorum from Japan—Deterioration of the Bermuda and Japan grown lilies—Recent efforts to cultivate the Easter lily in the United States—Lines of investigation carried on by the Department of Agriculture—Planting in the open ground—Reproduction from seed—Emasculating and pollenating the flowers—Sowing the seeds—Pricking off the seedlings—Description of plates.

*** No. 40. Cold Storage, with Special Reference to the Pear and Peach. By G. Harold Powell, Assistant Pomologist in Charge of Field Investigations, and S. H. Fulton, Assistant in Pomology. 1903. 28 pp., 7 pls. (including 5 in colors). Price, 15 cents.**

CONTENTS: The function of cold storage—The purposes of fruit storage—Influence of cold storage on the pear industry—Practical difficulties in pear storage—Outline of experiments in pear storage: The influence of the degree of maturity on keeping quality; the influence of delayed storage on keeping quality; the influence of different temperatures on keeping quality; the influence of the type of package on keeping quality; the influence of a wrapper on keeping quality; the influence of cold storage on the flavor and aroma of the fruit; the behavior of the fruit when removed from storage; summary—Influence of cold storage on the peach industry—Practical difficulties in peach storage—Outline of experiments in peach storage: General statement of results—Description of plates.

* No. 41. The Commercial Grading of Corn. By Carl S. Scofield, Expert, Grain Investigations. 1903. 24 pp., 4 pls. Price, 10 cents.

CONTENTS: Introduction—Inspection departments—Grain grading: Corn—Definite grade standards—Grade uniformity—Essential elements in grading corn—Apparatus required—Methods of determination: Moisture; color; damaged grains; broken grains and dirt—Classes and grades of corn—Inspection certificates—The cause of deterioration—Local and special grades—Description of plates.

* No. 42. Three New Plant Introductions from Japan. By David G. Fairchild, Agricultural Explorer. 1903. 24 pp., 6 pls. Price, 10 cents.

CONTENTS: Mitsumata, a Japanese paper plant: Introduction; species of paper plants in Japan; the mitsumata plant; the cultivation of mitsumata; the manufacture of mitsumata paper; the manufacture of leather paper—Udo, a new winter salad: Introduction; the cultivation of kan udo; the cultivation of moyashi udo—Wasabi, the horse-radish of the Japanese: Introduction; the cultivation of wasabi—Description of plates.

No. 43. Japanese Bamboos and Their Introduction into America. By David G. Fairchild, Agricultural Explorer. 1903. 36 pp., 8 pls. Price, 10 cents.

CONTENTS: Introduction—General considerations—General characters of the Japanese bamboos—Propagation of Japanese bamboos—Suitable location and soil conditions for bamboos—Japanese management of bamboo groves—Profits of bamboo culture in Japan—Culture of the edible bamboo—Different species of bamboos: Phyllostachys mitis; Phyllostachys quilioi; Phyllostachys henonis; "Madaradake" or "Ummon-chiku"; Phyllostachys nigra; Phyllostachys castillonis; Phyllostachys aurea; Phyllostachys bambusoides; Phyllostachys marliacea; Arundinaria japonica; Arundinaria simoni; Arundinaria hindsii; Arundinaria hindsii, var. graminea; Bambusa veitchii; Bambusa palmata; Bambusa quadrangularis; Bambusa vulgaris; "Shakutan"—Description of plates.

* No. 44. The Bitter-Rot of Apples. By Hermann von Schrenk, Special Agent in Charge of the Mississippi Valley Laboratory, and Perley Spaulding, Special Agent. 1903. 54 pp., 9 pls., 9 figs. Price, 15 cents.

CONTENTS: Introduction—Historical account of the bitter-rot—Distribution of the bitter-rot fungus: Geographical distribution; occurrence on various hosts—General description of the bitter-rot: Time of appearance; character of the spots; cause of the bitter-rot; rate of development of the bitter-rot; the diseased apple—The bitter-rot fungus: Life history on apples; the conidia; growth in cultures; conidial and ascus stages; the name of the bitter-rot fungus—The canker stage: Discovery of the canker; description of the canker stage—Relation of the cankers to the bitter-rot—Spread of the bitter-rot—Remedial measures: Removal of diseased fruits and mummies; removal of limb cankers; spraying with fungicides—Summary and recommendations—Index to literature—Description of plates.

No. 45. The Physiological Rôle of Mineral Nutrients in Plants. By Oscar Loew, Professor of Agricultural Chemistry in the Imperial University of Japan. 1903. 70 pp. Price, 5 cents.

CONTENTS: General remarks on the mineral constituents found in organisms: Historical notes; mineral compounds found in organisms; variety of

functions of mineral substances; general value of certain mineral salts; the low atomic weight of the mineral nutrients—The physiological rôle of phosphoric acid: Relation of phosphoric acid to proteids and to the division of cells; the physiological importance of lecithin; phosphoric acid in chlorophyll; potassium phosphate as a cell constituent—The physiological rôle of silica—The physiological rôle of iron compounds: Relation between the coloring matter of the blood and of the leaf; influence of iron and other mineral nutrients on the formation of chlorophyll; fertilizing effect of iron salts; organic compounds containing iron; iron in fungi; manganese in plants—The physiological rôle of halogen compounds: Plants raised without chlorids; value of potassium chlorid for buckwheat; beneficial and injurious action of chlorids; absorption of chlorids by aquatic plants; sodium chlorid in animals; fluorids in physiological relations; behavior of plants to potassium bromid; relations of organisms to iodin compounds—The physiological rôle of alkali salts: Importance of potassium for the formation of starch and protein; beneficial action of sodium salts upon plants; necessity of sodium salts for animals; can potassium salts be replaced by rubidium salts in green plants and in animals?; behavior of fungi toward rubidium salts; physiological superiority of potassium salts—The physiological rôle of calcium and magnesium salts: Distribution of lime and magnesia in plants; the physiological importance of lime salts in plants; views on the functions of lime salts; formation of lime incrustations; can calcium in plant cells be replaced by strontium?; poisonous action of magnesium salts; life without lime salts; possible relations between lime and the transportation of starch; the physiological rôle of magnesium salts; increase of magnesia in oily seeds; necessity of magnesium salts for fungi; can magnesium salts be replaced by beryllium salts?; importance of lime salts for animals; proportions of lime and magnesia in animal organisms; behavior of animals to strontium salts and oxalates; final remarks.

* No. 46. The Propagation of Tropical Fruit Trees and Other Plants. By George W. Oliver, Expert. 1903. 28 pp., 8 pls. Price, 10 cents.

CONTENTS: Introduction—The mango: Prospects as a fruit tree; propagation in India; propagating tests at the Department; best age for wood; thick bark of mango an obstacle in budding; knife for budding the mango; methods which show best results; applying the buds; when to bud; selection of budding material; a second method of attaching the bud; raising seedling stocks; transplanting young seedlings; importing mango scions—The loquat: Regions where the loquat may be grown; raising seedling stocks—The fig: Cuttings; grafting and budding—Tea: Necessity for vegetative propagation; veneer grafting; herbaceous grafting; propagating house; cuttings—Manila hemp: Importance of introduction into the United States; raising plants from seeds; cultivation in the Philippine Islands—Description of plates.

* No. 47. The Description of Wheat Varieties. By Carl S. Scofield, Botanist in Charge of Grain Grade Investigations. 1903. 19 pp., 1 folding table, 7 pls. Price, 10 cents.

CONTENTS: Introduction—Explanation of form used in the description of wheat varieties—Description of plates.

No. 48. The Apple in Cold Storage. By G. Harold Powell, Assistant Pomologist in Charge of Field Investigations, and S. H. Fulton, Assistant in Pomology. 1903. 66 pp., 6 pls. (including 5 in colors). Price, 15 cents.

CONTENTS: Introduction—Influence of cold storage on the apple industry—The extent of the cold-storage warehousing industry—The function of the cold-storage warehouse—Principles of mechanical refrigeration: The utilization of the cold temperatures; the direct-expansion system; the brine-circulating system; the air-circulating system—Outline of experiments in apple storage—Factors influencing the keeping quality of apples: The maturity

of the fruit when picked; how to obtain more uniform and better colored fruit; influence of delaying the storage of the fruit; influence of storage temperature; influence of a fruit wrapper; influence of cultural conditions; influence of the type of package—The behavior of the fruit when removed from storage—The importance of good fruit—Apple scald: Nature of the scald; influence of maturity of the fruit on scald; influence of temperature on scald; the temperature in which the fruit is removed from the storage house; influence on scald of delaying the storage of the fruit after it is picked; influence of a fruit wrapper on scald; varieties most susceptible to scald; treatment to prevent scald—Comparison of varieties in cold storage—Outline of cultural conditions—Variety catalogue—Summary—Description of plates.

* No. 49. The Culture of the Central American Rubber Tree. By O. F. Cook, Botanist in Charge of Investigations in Tropical Agriculture. 1903. 86 pp., 18 pls. Price, 25 cents.

CONTENTS: Introduction—The status of Castilla rubber culture: Castilla versus Hevea; uncertainties attending rubber culture; extent of the Castilla rubber industry; Castilla in the West Indies; Castilla culture for Porto Rico; rubber in the Philippines—Botanical study of Castilla: Difficulties in studying tropical trees; the original description of Castilla; description and botanical characters; species and varieties of Castilla; Hooker's monograph of Castilla; Costa Rican species of Castilla; field notes on Castilla in Guatemala and southern Mexico; habits of Castilla in the wild state; the rubber tree and the trumpet tree; Castilla not a genuine forest tree—Improvement of rubber trees by selection—Problems presented by the latex, or "milk": Evolutionary arguments regarding latex; functions ascribed to latex; the structure of latex; seasonal influences on latex; latex in desert plants; water storing as a function of latex; significance of multiple tapping—Climate and rubber production: A continuously humid climate not necessary for Castilla; greater abundance of Castilla on the drier Pacific slope; freer flow of milk in drier regions; decrease of milk with altitude and continuous humidity; Castilla in Nicaragua; Castilla in Costa Rica; Castilla on the Isthmus of Panama; analogy of the Assam rubber tree; the Para rubber tree in humid localities; productiveness of Para rubber trees in dry situations; the true climate of Hevea—The culture of Castilla: Shade in the culture of Castilla; shade not a necessity; relative cost of shade culture; effect of shade on form of tree; shade and rubber production; leguminous shade trees to be preferred; distance between trees; methods of clearing land for rubber planting; clean culture with forest protection; methods of handling Castilla seeds; seed beds and nurseries; propagation of Castilla from cuttings; Castilla as a shade tree—Extraction of the latex of Castilla: Primitive methods of tapping; age at which planted trees may be tapped; direction and shape of incisions; tapping instruments; multiple tapping; protection against thieves—Methods of coagulating the latex of Castilla: Coagulation by creaming; discoloration of Castilla latex; other methods of coagulation; coagulation of scrap rubber—Productiveness of Castilla: Yield of wild trees; yield of cultivated trees—Profits and prospects of Castilla culture: Management of rubber plantations; security of investments in rubber plantations; requirements for successful rubber plantations; opinion of the United States consul-general in Mexico—Concluding summary—Description of plates.

* No. 50. Wild Rice: Its Uses and Propagation. By Edgar Brown, Botanist in Charge of Seed Laboratory, and Carl S. Scofield, Botanist in Charge of Grain Grade Investigations. 1903. 24 pp., 7 pls. Price, 10 cents.

CONTENTS: Introduction—Distribution and habitat of the plant—Life history and natural propagation—Botanical description: General morphology; the root; the stem; the leaves; the panicle—Varieties—Diseases—Harvesting the seed—Preparation of the seed for food purposes—The food value of wild rice—Artificial propagation—Previous failures in planting—Plantings made in 1902—Storing seed—Suggestions for harvesting, storing, and planting—Description of plates.

* No. 51. Miscellaneous Papers. I. The Wilt Disease of Tobacco and Its Control. By R. E. B. McKenney, Physiologist. II. The Work of the Community Demonstration Farm at Terrell, Tex. By Seaman A. Knapp, Special Agent. *III. Fruit Trees Frozen in 1904. By M. B. Waite, Pathologist. IV. The Cultivation of the Australian Wattle. By David G. Fairchild, Agricultural Explorer. *V. Legal and Customary Weights per Bushel of Seeds. By Edgar Brown, Botanist in Charge of Seed Laboratory. VI. Golden Seal. By Alice Henkel, Assistant, and G. Fred Klugh, Scientific Assistant. 1905. 46 pp., 5 pls., 5 figs. Price, 5 cents.

CONTENTS: The wilt disease of tobacco and its control: The disease—Cause of the disease—Control of the disease. The work of the community demonstration farm at Terrell, Tex.: Introduction—Results accomplished—Methods employed—Description of the farm—Fertilizers used—Cotton—Corn. Fruit trees frozen in 1904: Introduction—Damage to bearing peach orchards: How to treat the peach orchards—Injury to plum trees—Injury to nursery trees—Damage to pear trees. The cultivation of the Australian wattle. Legal and customary weights per bushel of seeds: Introduction—Legal weights per bushel—Customary weights per bushel. Golden Seal: History—Habitat and range—Common names—Description of the plant—Description of the rhizome, or rootstock—Collection and preparation of the root—Diminution of supply—Cultivation: Necessary soil conditions; fertilizers; artificial shade; use of trees as shade; attention required; methods of propagation; experiments with seeds; experiments with divided rhizomes; experiments with plants from fibrous roots; yield of roots; time necessary to mature crop—Market conditions: Highest and lowest prices.

* No. 52. Wither-Tip and Other Diseases of Citrous Trees and Fruits Caused by Colletotrichum Gloeosporioides. By P. H. Rolfs, Pathologist in Charge of Subtropical Laboratory. 1904. 22 pp., 6 pls. (including 3 in colors), 1 fig. Price, 15 cents.

CONTENTS: Introduction—Distribution of the diseases—General method of attack: Extent of injury—Varieties attacked—Lime: Anthracnose; wither-tip; fruit canker—Lemon: Leaf-spot and wither-tip; lemon-spot; the coloring house; the coloring bed—Orange and pomelo: Leaf-spot; wither-tip—Description of the fungus: Synonymy—Preventive and remedial measures: Treatment to prevent lemon-spot; treatment of lime trees; the effect of pruning; cultivation and fertilization; fertilizers—Summary—Description of plates.

* No. 53. The Date Palm and Its Utilization in the Southwestern States. By Walter T. Swingle, Physiologist in Charge of Laboratory of Plant Life History. 1904. 155 pp., 22 pls., 10 figs. Price, 20 cents.

CONTENTS: Introduction—What is the date palm?—Date culture by the ancients—Propagation of the date palm: Seedling palms; seedling date palms for the Salton Basin; propagation of the date palm by offshoots; distances between trees; proportion of male trees that should be planted; varieties of male date palms—Care to be given date palms: The age at which date palms begin bearing; pollination of the date palm; gathering, curing, and packing dates—Types of dates and varieties suitable for culture in the United States: The three types of dates; varieties of dates suitable for culture in the United States; the Deglet Noor date; the Khalas date; other promising dates; the ordinary dates of commerce; varieties of dates that should be secured for trial in the United States; introduction of Saharan varieties of date palms into the United States—The date palm as a shelter for other fruit trees—Irrigation of the date palm: Amount of water necessary for a date palm; warm irrigation water advantageous—Drainage for the date palm—Effects of atmospheric humidity and rain on the date palm: Rainy weather disastrous to the flowers and ripening fruits of the date palm—Sunshine necessary for the date palm—Heat requirements of the date palm: Resistance of the date palm to cold in winter; the date palm flowers late in spring and escapes injury by late frosts; drainage of cold air and inversion of temperature in relation to date culture; hot summers necessary for the date palm; amount of heat required to mature the date—Effects of wind on the date palm—Resistance of the date palm to alkali: Investigation of the alkali-resisting power of the date palm in the Sahara; alkali conditions in relation to date culture at Biskra, Algeria; alkali conditions in relation to date culture at Fougala, Algeria; alkali conditions in relation to date culture at Chegga, Algeria; alkali conditions in relation to date culture at M'raïer, Algeria; alkali conditions in relation to date culture at Ourlana, Algeria; previous and subsequent analyses of alkaline soils from the Sahara; drainage water from alkaline soils used to irrigate date palms in the Sahara; alkali conditions in relation to date culture in the Salt River Valley, Arizona; alkali conditions in relation to date culture in the Salton Basin, California; geography and geology of the Salton Basin; water supply of the Salton Basin; soil conditions in the Salton Basin; alkali conditions at Palm Canyon in the foothills bordering the Salton Basin; chemical composition of the alkali of the Salton Basin; fertility of the soils of the Salton Basin; subsidiary cultures to follow in connection with date plantations on alkaline soils; limits of alkali resistance of the date palm; resistance of the date palm to chlorids; resistance of the date palm to sulphates; resistance of the date palm to carbonates (black alkali)—Regions in the United States where date culture can succeed: California; Salton Basin or Colorado Desert; Death Valley; Colorado River Valley; plateau region; interior valley region; coast region of southern California; Nevada; Arizona; Salt River Valley; Colorado River Valley; New Mexico; Texas—No danger from Mexican competition in date culture—Profits of date culture: Extent of the market—Importance of life-history investigations in demonstrating the feasibility of date culture—Summary—Description of plates—Index.

No. 54. Persian Gulf Dates and Their Introduction into America. By David G. Fairchild, Agricultural Explorer. 1903. 32 pp., 4 pls. Price, 10 cents.

CONTENTS: Introduction—General description of the region—Climate—Location of the date gardens—Soil conditions—Irrigation of the plantations—Secondary cultures between the palms—Treatment of the soil and planting of young palms—Pollination—Different varieties of the region: Bagdad varieties; Kustawi; Ascherasi; Bedraihe; Maktum; Burni; Zehedi; Barban; Sukeri; Taberzal; Mirhage; Bassorah varieties; Berhi; Hevezi; Sayer (or Ustaamran); Halawi; Khadrawi; Hassa varieties; Khalasa (or Khalasi); Jask varieties; Bunder Abbas varieties; Maskat varieties; Fard; Burni; Nagal; Mubsali; Khanezi; Khassab; Hellali; Guadur varieties—Diseases and pests—Cost and profits of date culture—Packing and shipment of dates—The date as a food—Description of plates.

N. 55. The Dry-Rot of Potatoes Due to Fusarium Oxysporum. By Erwin F. Smith and Deane B. Swingle, Laboratory of Plant Pathology. 1904. 64 pp., 8 pls., 2 figs. Price, 10 cents.

CONTENTS: Introduction—Effect of the disease on the plants—Effect of different fertilizers on resistance to the disease—Description of the fungus: Mycelium; Microconidia; Macroconidia; Chlamydospores; Sclerotia; growth in different media; growth in alkalis; growth in acids; growth in the absence of free oxygen; reaction to sunlight; range of temperature for growth; name of the fungus—Geographical distribution of the disease—Remedial measures—Culture media used—Summary—Literature—Description of plates.

* No. 56. Nomenclature of the Apple; a Catalogue of the Known Varieties Referred to in American Publications from 1804 to 1904. Compiled by W. H. Ragan, Expert in Pomological Nomenclature. 1905. [Additions and Corrections. 1905.] 395 pp. Price, 30 cents.

CONTENTS: Introduction—Code of nomenclature of the American Pomological Society: Priority; form of names; publication; revision—Key to the abbreviations used in citations of authors and publications: Alphabetical list of abbreviations used in designating the publications quoted—Catalogue of the known varieties of apples referred to in American publications from 1804 to 1904—Index to the American literature of the apple, 1804 to 1904—Additions and corrections.

No. 57. Methods Used for Controlling and Reclaiming Sand Dunes. By A. S. Hitchcock, Assistant Agrostologist, in Charge of Cooperative Experiments. 1904. 36 pp., 9 pls., 9 figs. Price, 10 cents.

CONTENTS: Introduction—Formation of sand dunes: Action of the wind upon drifting sand—Artificial fixation of dunes: Binding the sand; binding by means of grasses; transplanting; arrangement of the plantation; formation of the barrier dune; binding by means of heather; laying the heather; binding with sand hedges; forestation—Fixation as observed in Europe: The Netherlands: coastal dunes; interior dunes; Denmark; Oxböl; Skagen; Germany; France—Summary—Description of plates.

* No. 58. The Vitality and Germination of Seeds. By J. W. T. Duvel, Assistant in the Seed Laboratory. 1904. 96 pp., 2 figs. Price, 10 cents.

CONTENTS: Introduction—Materials and methods: Seeds; germination tests and apparatus—Effect of climatic conditions on the vitality of seeds—Causes of the losses in vitality in different climates—Effect of moisture and temperature upon vitality: Seeds packed in ice; effect of moisture on vitality at higher temperatures; summary—The effect of definite quantities of moisture on the vitality of seeds when they are kept within certain known limits of temperature—A comparison of methods of storing and shipping seeds in order to protect them from moisture, and consequently to insure a better preservation of vitality: Suggestions of earlier investigations; the necessity for thoroughly curing and drying seeds; character of the seed warehouse or storage room; the value of good seed to the market gardener; shipping seeds in charcoal, moss, etc.; nature of the experiments; disposition of the samples; results of the germination tests—Experiments in keeping and shipping seeds in special packages—Respiration of seeds: Summary—Enzymes in seeds and the part they play in the preservation of vitality—Summary—Literature cited—Index.

No. 59. Pasture, Meadow, and Forage Crops in Nebraska. By T. L. Lyon, Agriculturist, Nebraska Experiment Station, and A. S. Hitchcock, Assistant Agrostologist, in Charge of Cooperative Experiments, U. S. Department of Agriculture. 1904. 64 pp., 6 pls., 8 figs. Price, 10 cents.

CONTENTS: Introduction—Climatic and soil conditions of Nebraska: Rainfall; temperature; physiography; soil—Crops—Classification of forage plants: Duration; perennials; annuals; natural groups; legumes; grasses; miscellaneous; methods of utilizing the crops; pastures; meadows; soiling crops; silage—Results of experiments with grasses and forage plants at the Nebraska Experiment Station: Grasses and forage plants which have given successful results; brome-grass; results of cooperative experiments; alfalfa; cooperative experiments with alfalfa; alfalfa seed from different sources; Turkestan alfalfa; Peruvian alfalfa; Samarkand alfalfa; seed from different States; other experiments with alfalfa; meadow fescue; orchard grass; timothy;

clovers; Kentucky bluegrass; redtop; side-oats grama; wheat-grasses; grasses and legumes of less importance—Pastures and meadows: Native grasses: care of native pastures and meadows; tame pastures at the Nebraska Experiment Station; the seed bed for grasses and clovers—Annual forage crops: Sorghum; millet; cowpea; small grains; corn; soy bean; rape; Canada field pea; vetch—Plants which can not be recommended—Index of grasses and forage plants—Description of plates.

* No. 60. A Soft Rot of the Calla Lily. By C. O. Townsend, Pathologist. 1904. 47 pp., 9 pls., 7 figs. Price, 10 cents.

CONTENTS: Introduction—Cause of the calla rot—General appearance of the disease—Effect of the organism on the calla—Morphological characters of the organism—Physiological characters of the organism: Nutrient media; beef broth; agar plate cultures; agar streak cultures; agar stab cultures; beef agar, with iron sulphate; gelatin stab cultures; egg albumen; milk; litmus milk; litmus milk in nitrogen; Uschinsky's solution; Dunham's solution; Dunham's solution, with acid fuchsin; Dunham's solution, with indigo-carmine; peptone solution, with rosolic acid; Dunham's solution, with methylene blue; steamed potato cylinders; raw potato; raw eggplant; raw cauliflower; raw radish; raw cucumbers, sliced; raw cucumbers, whole; raw green peppers; raw mature onions bulbs; raw young onions; raw pieplant; raw cabbage; raw parsnips; raw carrots; raw turnips; raw salsify; raw tomatoes, ripe; raw tomatoes, green; raw apples (York Imperial); raw pineapples; raw yellow bananas; gas; action on lead acetate; indol; nitrates reduced to nitrites; maximum temperature; minimum temperature; optimum temperature; thermal death point; diffused light; direct sunlight; effect of nitrogen; effect of carbon dioxid; effect of hydrogen—Comparison of calla-rot germ with similar organisms: Bacillus carotovorus Jones; Bacillus oleraceæ Harrison; Heinz's hyacinth germ (Bacillus hyacinthi septicus); Potter's Pseudomonas destructans—Origin and spread of the disease—Remedies—Summary—Description of plates.

No. 61. The Avocado in Florida; Its Propagation, Cultivation, and Marketing. By P. H. Rolfs, Pathologist, in Charge of Subtropical Laboratory. 1904. 36 pp., 4 pls., 9 figs. Price, 5 cents.

CONTENTS: Introduction—The name avocado—Literature—Distribution and time of blooming—The avocado for wind-breaks and shade trees—Methods of starting an orchard: The seed bed; the nursery; cultivation in the nursery; budding; grafting; transplanting to the field; top-working trees; cultivation; fertilizers—Superiority of budded trees—Variation of fruit from seedling trees: Description of variations—Marketing: Picking; grading and sizing; packing—The fruit: The edible portion; seed and seed cavity—Shape of the tree—Forms and varieties: The Mexican avocado; the West Indian-South American avocado; the ideal avocado—Uses of the fruit—Diseases: Leaf disease; remedy; fruit disease; remedy—Summary—Description of plates.

No. 62. Notes on Egyptian Agriculture. By George P. Foaden, B. Sc., Secretary of the Khedivial Agricultural Society, Cairo, Egypt. 1904. 61 pp., 6 pls., 3 figs. Price, 10 cents.

CONTENTS: Introduction—Composition of Nile mud during flood—Irrigation and fertilizers—Soils—Labor—Value of land—Animal labor—Seasons—Cotton: Distance between the cotton beds; date of planting cotton; sowing cotton; watering cotton; manuring cotton; summary—Varities of cotton grown in Egypt: Ashmouni; lower Egypt cottons; Mit Afifi; Abbasi; Jannovitch—Seed selection—Picking cotton—Marketing cotton—Cotton and cotton-seed exports—Sugar cane—Beets—Berseem, or Egyptian clover—Lucern (alfalfa)—Corn—Wheat and barley—Beans—Rice—Onions—Millets and sorghums—Minor crops: Lentils; earth nuts, or peanuts; chick-peas; lupines; fenugreek; flax.

No. 63. Investigations of Rusts. By Mark Alfred Carleton, Cerealist in Charge of Cereal Investigations. 1904. 32 pp., 2 pls. in colors. Price, 10 cents.

CONTENTS: Additions to our knowledge of life histories: Euphorbia rust (Uromyces euphorbiæ C. and P.); sunflower rust (Puccinia helianthi Schw.); crown rust of oats (Puccinia rhamni [Pers.] Wettst.)—Segregaton of host plants: Black stem rust of Agropyron and Elymus; orange leaf rust of Agropyron and Elymus; black stem rust of Agrostis alba vulgaris; rust of Chloris (Puccinia chloridis Diet.); rusts of willow and cottonwood (Melampsora)—Winter resistance of the uredo: Uredo of Kentucky bluegrass rust (Puccinia poarum Niels.); uredo of Puccinia montanensis Ell.—Emergency adaptations: Puccinia vexans Farl.—Experiments with Lepto-uredineæ: Rust of cocklebur (Puccinia xanthii Schw.); rust of velvet leaf (Puccinia heterospora B. and C.)—Perennial species: Aecidium tuberculatum E. and K.; rust of Peucedanum fœniculaceum—Description of plates.

* No. 64. A Method of Destroying or Preventing the Growth of Algæ and Certain Pathogenic Bacteria in Water Supplies. By George T. Moore, Physiologist and Algologist in Charge of Laboratory of Plant Physiology, and Karl F. Kellerman, Assistant in Physiology. 1904. 44 pp. Price, 5 cents.

CONTENTS: Introduction—Microscopical examination of drinking water—Wide distribution of trouble caused by algæ in water supplies—Methods in use for preventing bad effects due to algæ—Desirability of other methods—Determination of a physiological method—Effect of copper sulphate—Method of applying the copper sulphate—Practical tests of the method: Water-cress beds; water reservoirs—Effect of copper upon pathogenic bacteria: Typhoid; Asiatic cholera—Comparison of effect of other disinfectants—Colloidal solutions—Conclusions: Necessity of knowledge of organism and condition in reservoir; application of method for destruction of pathogenic bacteria not designed to replace efficient means of filtration already in use; medicinal use; conditions under which the Department of Agriculture can furnish information and assistance in applying this method—Cost—Summary.

No. 65. Reclamation of Cape Cod Sand Dunes. By J. M. Westgate, Assistant in Sand-Binding Work. 1904. 38 pp., 6 pls. Price, 10 cents.

CONTENTS: Introduction—Ecological relations of the vegetation: Ecological factors; mode of deposition of the Cape sands; development of the dune range; natural reclamation; areas receiving gradual accumulations of sand; areas not receiving gradual accumulations of sand; marshes and bogs; early accounts—Devastation of the established dune areas: Early conditions incident to the devastation; restrictive legislation—Artificial reclamation of the Cape sands: Early work of sand control; recent work by the State; preliminary operations; attempts without beach grass; utilization of beach grass; relative merits of spring and fall planting; selecting and transplanting the sets; cost of planting; present status of the various plantings; effectiveness of brush laying; efficiency of beach grass for sand binding; necessity of ultimate forestation; miscellaneous operations on the sand; road construction; reclamation of small areas; commercial utilization of sand; development of the protective beach ridge—The Province lands: State ownership; value of the lands—Summary—Bibliography—Description of plates.

* No. 66. Seeds and Plants Imported During the Period from September, 1900, to December, 1903. Inventory No. 10; Nos. 5501-9896. 1905. 333 pp. Price, 15 cents.

CONTENTS: Introductory statement—Inventory of seeds and plants imported—Index of common and scientific names.

No. 67. Range Investigations in Arizona. By David Griffiths, Assistant in Charge of Range Investigations. 1904. 62 pp., 10 pls., 1 fig. Price, 15 cents.

CONTENTS: Introduction—The small inclosure—The large inclosure: Topography; soil; brush and timber; forage plants; amount of feed produced—Carrying capacity—Water for stock—The seasons—Erosion—The prairie dog—Range feed: The grasses; pigweed family; the clovers; alfilerilla; miscellaneous winter and spring annuals; miscellaneous browse plants—Hay crops—Weeds—Plants injurious to stock—Summary—Description of plates.

* No. 68. North American Species of Agrostis. By A. S. Hitchcock, Systematic Agrostologist in Charge of Herbarium. 1905. 68 pp., 37 pls., 2 figs. Price, 10 cents.

CONTENTS: Introduction: Taxonomy; nomenclature; plates; specimens listed—History of the genus—Generic description—Key to species—Description of species—Species excluded—Notes on Mexican species—Index to species and synonyms—Description of plates.

No. 69. American Varieties of Lettuce. By W. W. Tracy, jr., Assistant, Variety Trials. 1904. 103 pp., 27 pls. Price, 15 cents.

CONTENTS: Introduction—Varieties and their description: Nomenclature; environment and selection; source of seed—Cultural peculiarities—Terms used in description: Classes; size; maturity; shooting to seed; habit; leaves; color; seeds; seedling plants—Varieties suited to different conditions and requirements—Table of varieties—Classification of varieties—Key to varieties—Description of varieties classed as distinct—Catalogue of variety names.

No. 70. The Commercial Status of Durum Wheat. By Mark Alfred Carleton, Cerealist in Charge of Cereal Investigations, and Joseph S. Chamberlain, Physiological Chemist, Cereal Investigations. 1904. 70 pp., 5 pls., 1 fig. Price, 10 cents.

CONTENTS: Introduction—Proper rank of durum wheat—Special qualities of commercial value—The name "durum"—Durum wheat for macaroni: Characteristics of good macaroni; process of manufacture; list of manufacturers of macaroni in the United States; possibility of export of semolina and macaroni; methods of cooking and serving macaroni; recipes; semolina; soups; macaroni with cheese or milk; macaroni with tomatoes; macaroni with meats; macaroni with nuts; timbales; croquettes; garnitures; spaghetti; salads; desserts; special Italian recipes; miscellaneous—Durum wheat for bread: Private experiments; cooperative baking experiments of the Department of Agriculture; chemical study of durum-wheat flour and bread; examination of standard flours; total proteids; gliadin and glutenin; conclusions; examination of the flour and bread of the baking test; conclusions; reports on trials of the bread; grain dealers; millers; bakers; teachers and experts in domestic science; chemists and flour experts; technical journals; quotations from particularly interesting reports; results of other tests; remarks on the various chemical and baking tests; the color of flour and bread; experience required for perfect operations—Other products from durum wheat—Progress of the new industry: Increase in production of durum wheat; determination of the best varieties; commercial inspection and grading; disposition of the 1903 crop; mills now handling the wheat; prices; the outlook—Description of plates.

* No. 71. Soil Inoculation for Legumes; with Reports upon the Successful Use of Artificial Cultures by Practical Farmers. By George T. Moore, Physiologist in Charge of Laboratory of Plant Physiology. 1905. 72 pp., 10 pls. Price, 15 cents.

Contents: Introduction—The fixation of free nitrogen—Beneficial effect of leguminous crops—Direct effect of nodules upon legumes—Effect of nodule-bearing legumes upon succeeding crops—Artificial inoculation of the soil—Soil transfer—Nitragin—Nature of the organism—Cross-inoculation and specific characters—Methods of cultivation—Effect of varying conditions: Light, heat, and air; acids and alkalis; nitrates; moisture—Where is nitrogen fixed?—Nodules not always beneficial—Symbiosis or parasitism?—Infection and fixation of nitrogen without nodules—Inoculation by pure culture—Methods of using liquid culture—Time of inoculation—When inoculation is unnecessary—When inoculation is necessary—When to expect failure with inoculation—Results—Reports: Alfalfa; red clover; cowpeas; garden peas; beans; soy beans; hairy vetch; crimson clover; sweet peas; field peas; velvet beans; berseem; peanuts; miscellaneous—Summary.

* No. 72. Miscellaneous Papers. I. Cultivation of Wheat in Permanent Alfalfa Fields. By David Fairchild, Agricultural Explorer. II. The Salt Water Limits of Wild Rice. By Carl S. Scofield, Botanist, Grain Grade Investigations. * III. Extermination of Johnson Grass. By W. J. Spillman, Agrostologist. * IV. Inoculation of Soil with Nitrogen-Fixing Bacteria. By A. F. Woods, Acting Chief of Bureau. 1905. 30 pp., 3 pls., 4 figs. Price, 5 cents.

Contents: Cultivation of wheat in permanent alfalfa fields. The salt-water limits of wild rice: Introduction—The method of testing salinity—The regions investigated—Conclusions. Extermination of Johnson grass: Introduction—Character of the soil—Methods of treatment—Implements used—The production of hay. Inoculation of soil with nitrogen-fixing bacteria: Introduction—The commercial production of cultures—When inoculation is necessary—When inoculation may prove advantageous—When inoculation is unnecessary—When failure is to be expected—Cost of cultures—Increasing cultures—Preparing and using the culture solution—Keeping cultures for future use—Danger of inoculation by soil transfer—Pure-culture inoculation.

* No. 73. The Development of Single-Germ Beet Seed. By C. O. Townsend, Pathologist, and E. C. Rittue, Assistant. 1905. 26 pp., 8 pls., 6 figs. Price, 10 cents.

Contents: Introduction—Single and multiple germ beet seed—The beet flower—The first seed selection—Germination and vitality—Greenhouse experiments—Seed beets in 1903—Beet seed in 1903—Change of location of experiments—Progress of the work in 1904: Planting and growth of the seed beets; arrangement of single flowers; methods of pollination; gathering the seed; percentage of single-germ seeds—Conclusion—Description of plates.

No. 74. The Prickly Pear and Other Cacti as Food for Stock. By David Griffiths, Assistant Agrostologist in Charge of Range Investigations. 1905. 48 pp., 5 pls., 1 fig. Price, 5 cents.

Contents: Introduction—History—Geographical distribution of economic cacti in the United States—Methods of feeding: Singeing the spines; singeing with a torch; steaming; chopping by machinery; other chopping devices;

removal of the edge of the joints; handling the plants—Pear machinery: Origin of pear machinery; pear cutters; pear burners—Pear for milk production: Some dairy rations including pear—Pear for fattening and maintaining cattle—Pear as a hog feed—Pear for sheep and goats—Pear as a ration for working animals—Effect of pear upon stock—Cactus for the silo—Pear thickets and their destruction—Species of cactus which are of forage value—Establishing plantations of pear—Yield of pear—Behavior of pear after harvesting—Other economic aspects of the cacti—Some conditions obtaining in the prickly-pear region—Popular postulates of cactus feeding—Description of plates.

No. 75. Range Management in the State of Washington. By J. S. Cotton, Assistant in Range Investigations, in Cooperation with the Washington State Experiment Station. 1905. 28 pp., 3 pls. Price, 5 cents.

CONTENTS: Introduction—Range improvements: Winter pastures; semiarid lands; mountain grazing areas—Protection of pastures—Alternation of pastures—Using pastures before ground is settled in the spring—Improvement of stock—Index of grasses and forage plants—Description of plates.

No. 76. Copper as an Algicide and Disinfectant in Water Supplies. By George T. Moore, Physiologist and Algologist in Charge of the Laboratory of Plant Physiology, and Karl F. Kellerman, Assistant in Physiology. 1905. 55 pp. Price, 5 cents.

CONTENTS: Introduction—Difference in toxicity of copper sulphate in laboratory and field conditions—Effect of copper sulphate upon fish—Conditions determining the proper quantity of copper sulphate for eradicating algæ—Appearance of resistant forms of algæ in reservoirs previously treated—Odor and taste due to large numbers of algæ killed—Reports from various cities and towns upon the effect of treatment: Baltimore, Md.; Bond Hill, Cincinnati, Ohio; Butte, Mont.; Cambridge, N. Y.; Elmira, N. Y.; Fieldhome, N. Y.; Glencove, Long Island, N. Y.; Greenwich, Conn.; Hanover, N. H.; Hanover, Pa.; Ivorydale, Ohio; Johnson Creek, Wis.; Middletown, N. Y.; Millersburg, Pa.; Moncton, New Brunswick; New York, N. Y.; Newtown, Pa.; Oberlin, Ohio; Passaic, N. J.; Port Deposit, Md.; Rhinebeck, N. Y.; Scarboro, N. Y.; Springfield, Ill.; Waltham, Mass.; Water Mill, Long Island, N. Y.; Wellsboro, Pa.; Winchester, Ky.; Winnebago City, Minn.—Necessity for determining the polluting organism—Troublesome forms and their identification: The Sedgwick-Rafter method of quantitative determination; key for identifying algæ—Method of applying copper sulphate—Sterilization of bacteria-polluted water by means of copper sulphate—Sterilization of the water supplies at Columbus, Ohio, and Albuquerque, N. Mex.—Sterilization of water by means of metallic copper—Copper in the disposal of sewage—Copper supplementing the use of filters—Copper treatment and filtration at Anderson, Ind.—Objections to the use of copper sulphate—Opinions of toxicologists upon the effect of copper sulphate—Medicinal use of copper—Conclusion—Summary.

No. 77. The Avocado, a Salad Fruit from the Tropics. By G. N. Collins, Assistant Botanist in Investigations in Tropical Agriculture. 1905. 52 pp., 8 pls. Price, 5 cents.

CONTENTS: Introduction—Origin and history: Early accounts; common names; not native in the West Indies; distribution—Description—Botanical affinities—Varieties—Geographical types: Guatemala; Porto Rico; Mexico; Costa Rica; Cuba; Hawaii—Culture: Propagation by seed; asexual propagation; soil; climate; cultivation; improvement; shipping qualities; uniformity; extension of season; seed reduction; texture; flavor; yield; size; resistance to cold—Diseases—The avocado in Porto Rico—The avocado in Hawaii—The avocado in Florida—The avocado in California—Bearing age and life of tree—Yield—Harvesting: Time to pick; method of gathering; packing and shipping—Cold storage—Marketing: Market season—Methods of eating—Food value—Cost of production—Summary—Description of plates.

* No. 78. Improving the Quality of Wheat. By T. L. Lyon, Agriculturist and Associate Director of the Agricultural Experiment Station of Nebraska, and Collaborator of the Bureau of Plant Industry. 1905. 120 pp. Price, 10 cents.

Contents: Object of the investigation. Part I. Historical: Some conditions affecting the composition and yield of wheat: Composition as affected by time of cutting; influence of immature seed upon yield; influence of climate upon composition and yield; influence of soil upon composition and yield; influence of soil moisture upon composition and yield; influence of size or weight of the seed-wheat kernel upon the crop yield; relation of size of kernel to nitrogen content; influence of the specific gravity of the seed kernel upon yield; relation of specific gravity of kernel to nitrogen content; conditions affecting the production of nitrogen in the grain. Part II. Experimental: Some properties of the wheat kernel—Yield of nitrogen per acre—Method for selection to increase the quantity of proteids in the kernel—A basis for selection to increase the quantity of proteids in the endosperm of the kernel—Improvement in the quality of the gluten—Some results of breeding to increase the content of proteid nitrogen—Yield of grain as affected by susceptibility to cold—Yield and nitrogen content of grain as affected by length of growing period—Relation of size of head to yield, height, and tillering of plant—Summary and conclusions.

No. 79. The Variability of Wheat Varieties in Resistance to Toxic Salts. By L. L. Harter, Scientific Assistant, Laboratory of Plant Breeding. 1905. 48 pp. Price, 5 cents.

Contents: Introduction—Salts used—Varieties selected: Preston; Turkey; Zimmerman; Kharkof; Padui; Chul; Budapest; Kubanka; Maraouani—Methods of experiments—Method of establishing the toxic limits—Results of experiments: With magnesium sulphate; with magnesium chlorid; with sodium carbonate; with sodium bicarbonate; with sodium sulphate; with sodium chlorid; summary of tables—Comparison of results with different species—Ash analyses—Individual variability—Neutralizing effect of the salts employed upon other toxic substances—Dilute solutions as stimulants—Practical value of results—Summary—Bibliography.

No. 80. Agricultural Explorations in Algeria. By Thomas H. Kearney, Physiologist, Vegetable Pathological and Physiological Investigations, Bureau of Plant Industry, and Thomas H. Means, Formerly of the Bureau of Soils. 1905. 98 pp., 4 pls. Price, 10 cents.

Contents: Introduction—Topography: Coast region; high plateau or steppe region; desert region—Climate: Coast region; temperature; humidity; precipitation; wind; high plateau region; desert region; temperature; humidity; precipitation—Irrigation: Coast region; high plateau region; desert region—Soils: Coast region; littoral zone; valley and plain zone; mountain zone; high plateau region; desert region; saline soils; coast region; desert region; soil management; rotations; fertilizers; preparation of the land; clearing and leveling; plowing—General economic conditions: Historical and political; land values; farm labor; agriculture of the native population; among the Arabs; among the Kabyles; among the Saharans—Crops of the colony: Geographical distribution; coast region; littoral zone; valley and plain zone; mountain zone; high plateau region; desert region; principal crops in detail; fruit crops; grapes; wine grapes; table grapes; olives; figs; citrus fruits; dates; less important orchard crops; truck crops; cereals; winter cereals; wheat; barley; oats; summer cereals; sorghum; Indian corn; forage crops; wild forage; fallow-land forage; forage of natural meadows and prairies; cultivated forage; leguminous crops; alfalfa, or lucern; horse beans; sulla; fenugreek; berseem; vetches; tree crops

as forage; carob, or St. John's bread; Indian fig; miscellaneous crops; tobacco; fiber plants; perfume plants—Live stock: Cattle; horses; donkeys; mules; camels; sheep; goats—Forestry: General conditions; forest products; fuel; timber; cork; tan bark; alfalfa; dwarf palm.

No. 81. Evolution of Cellular Structures. By O. F. Cook and Walter T. Swingle. 1905. 26 pp., 1 pl., 2 figs. Price, 5 cents.

CONTENTS: Introduction—The elimination of the simple-celled phase—Alternation of structural types—Sexuality a mechanism of evolution—Two types of double-celled structures—Heredity in reticular descent—Summary—Explanation of plate.

No. 82. Grass Lands of the South Alaska Coast. By C. V. Piper, Agrostologist in Charge of Forage Plant Introduction. 1905. 38 pp., 4 pls. Price, 10 cents.

CONTENTS: Introduction—The location of the grass lands: Kadiak Island; Alaska Peninsula and adjacent islands; Unalaska and the neighboring islands; Kenai Peninsula; the Yakutat plains—Important factors relating to the agricultural value of the grass lands: The abundance and permanence of native fodder plants; bluetop; beach rye; bluegrass; silver-top; Siberian fescue; sedges; Alaska lupine; fireweed; food value of native Alaskan grasses; cultivable forage crops; silage alone as a ration for milch cows; Alaskan experience in stock raising; hogs; goats; sheep husbandry; cattle; population and available markets; freights and transportation; desirability of south Alaska as a home; climate; garden products; fuel; choice of a location—Land laws applying to Alaska: Homesteads; application for a homestead for surveyed land; inceptive rights of homestead settlers; homestead settlers on unsurveyed lands; cultivation in grazing districts; homestead claims not liable for debt and not salable; soldiers and sailors' homestead rights; soldiers' additional homestead entry—Description of plates.

No. 83. The Vitality of Buried Seeds. By J. W. T. Duvel, Assistant in the Seed Laboratory. 1905. 22 pp., 3 pls., 1 fig. Price, 5 cents.

CONTENTS: Introduction—Kinds of seeds buried—How the seeds were buried—Germination tests—Relation of depth of burial to vitality—Hard seeds—Seeds of cultivated versus wild plants—Summary—Description of plates.

* No. 84. The Seeds of the Bluegrasses. I. The Germination, Growing, Handling, and Adulteration of Bluegrass Seeds. By Edgar Brown, Botanist in Charge of Seed Laboratory. II. Descriptions of the Seeds of the Commercial Bluegrasses and Their Impurities. By F. H. Hillman, Assistant Botanist, Seed Laboratory. 1905. 38 pp., 35 figs. Price, 5 cents.

CONTENTS: I. The germination, growing, handling, and adulteration of bluegrass seeds: Description of commercial and hand-gathering seeds—Grades and quality of commercial seeds—Adulteration—Weight per bushel—Germination—Growing and handling: Poa pratensis (Kentucky bluegrass); Poa compressa (Canada bluegrass); Poa trivialis (rough-stalked meadow grass); Poa nemoralis (wood meadow grass); Poa triflora (fowl meadow grass); Poa arachnifera (Texas bluegrass); Poa annua (annual bluegrass); Poa alpina (alpine meadow grass); Poa sudetica. II. Descriptions of the seeds of the commercial bluegrasses and their impurities: The bluegrasses: Key to the seeds of the more common species of Poa as found on herbarium specimens; key to commercial bluegrass seeds after preparation for market; comparison

THE PHILADELPHIA
DEC 20 1907

of the principal distinguishing characters of bluegrass seeds; descriptions of species; Poa pratensis L., Kentucky bluegrass, June grass; Poa compressa L., Canada bluegrass, flat-stemmed bluegrass; Poa trivialis L., rough-stalked meadow grass; Poa nemoralis L., wood meadow grass; Poa triflora Ehrh. (P. flava L., P. serotina Ehrh.), fowl meadow grass, false redtop; Poa arachnifera Torr., Texas bluegrass; Poa annua L., annual meadow grass; Poa alpina L., alpine meadow grass; Poa sudetica Haenke; Panicularia spp.; Panicularia nervata (Willd.) Kuntze, nerved manna grass, sometimes called fowl meadow grass; Panicularia americana (Torr.) MacM., reed meadow grass, water meadow grass, tall manna grass—Weed seeds commonly found with commercial bluegrass seeds: Bursa bursa-pastoris (L.) Britton, shepherd's-purse; Lepidium virginicum L., peppergrass; Cerastium vulgatum L., mouse-ear chickweed; Alsine media L., common chickweed; Alsine graminea (L.) Britton; Carduus arvensis (L.) Robs., Canada thistle; Taraxacum taraxacum (L.) Karst., dandelion; Matricaria inodora L., scentless camomile; Hieracium sp., hawkweed; Anthemis cotula L., dog fennel, mayweed; Chenopodium album L., lamb's quarters, pigweed; Plantago lanceolata L., rib-grass, buckhorn, English plantain; Rumex cripspus L., curled dock; Rumex acetosella L., sheep's sorrel, sorrel; Veronica arvensis L., corn speedwell; Juncus tenuis, Willd., slender rush; Juncoides campestre (L.) Kuntze, field rush; Juncoides albida DC., wood rush; Carex cephalophora Muhl., oval-headed sedge—Ergot occasionally found in commercial bluegrass seed: Claviceps purpurea (Fr.) Tul., ergot.

* No. 85. The Principles of Mushroom Growing and Mushroom Spawn Making. By B. M. Duggar, Professor of Botany in the University of Missouri, and Collaborator of the Bureau of Plant Industry. 1905. 60 pp., 7 pls. Price, 10 cents.

CONTENTS: Introduction—General considerations—Market conditions—Germination studies: Review of earlier work; experimental work—Tissue cultures—Nutrition: Growth on manure and other complex media; growth on chemically known media; tabulation of special results; acid and alkaline media—Temperature and moisture—Preparation of the compost—Installation of beds—Spawning and casing the beds—Mushroom growing: Experiments at Columbia, Mo.; variability in mushrooms grown under different conditions; the cultivation of various species of mushrooms; cooperative experiments—Cave facilities in the United States—Open-air culture—Mushroom spawn making: A "chance" method; a "selective" method; pure-culture precautions; the tissue-culture method; the commercial process—The vitality of mushroom spawn.

No. 86. Agriculture Without Irrigation in the Sahara Desert. By Thomas H. Kearney, Physiologist. 1905. 30 pp., 5 pls., 1 fig. Price, 5 cents.

CONTENTS: Introduction—Population—Climate—Water supply—Soils—The date gardens: Planting; care of palms; fighting the sand; manuring; harvest; yields; varieties chiefly grown—Conclusion—Description of plates.

No. 87. Disease Resistance of Potatoes. By L. R. Jones, Botanist of the Vermont Agricultural Experiment Station and Collaborator of the Bureau of Plant Industry. 1905. 39 pp. Price, 5 cents.

CONTENTS: Introduction—Potato culture in Europe—Observations on potato diseases and disease resistance in Europe: Certain minor diseases; internal brown spot; filosité, or growing-out; leaf-spot; scabbiness of tubers; potato scab; varietal resistance to scab; other scab-like diseases; potato stem diseases; blackleg; other stem diseases; late-blight and rot due to Phytophthora infestans—Resistance as shown toward late-blight and rot: Historical statement; the meaning of disease resistance; disease resistance and vegetative vigor; the relation of hybridity to disease resistance; improvement by selection; are early or late varieties the more resistant?; relation of source of seed and cultural methods to disease resistance; composition and character of tubers as related to rot resistance; character of stem and foliage as related to disease resistance—Disease-resistant varieties of Europe: Great Britain; Germany and Holland; France and Belgium—Disease-resistant varieties of America: Investigations at the experiment stations; work at the Vermont station; information secured by a circular of inquiry; resistance to scab—Summary.

No. 88. Weevil-Resisting Adaptations of the Cotton Plant. By O. F. Cook, Bionomist in Charge of Investigations in the Agricultural Economy of Tropical and Subtropical Plants. 1906. 87 pp., 10 pls. Price, 10 cents.

CONTENTS: Introduction—Selective influence of the boll weevil—General protective characters: Dwarf habit and determinate growth of Kekchi cotton; variations in the Kekchi cotton; effects of Guatemalan conditions on United States varieties; acclimatization of Kekchi cotton in the United States; early bearing facilitated by long basal branches; early rejection of superfluous squares; seasonal bearing of perennial varieties; annual cutting back of perennial varieties; hairy stalks and leaf stems; pendent bolls—Extrafloral nectaries: Nectaries of the leaves; external nectaries of the involucre; inner nectaries of the involucre; nectaries of Guatemalan Sea Island cotton; continued secretion of nectar; bractlets subtending inner nectaries; efficiency of the kelep protection; other nectar-bearing plants visited by the keleps—The involucre as a protective structure: Involucral bracts grown together; appressed margins of bracts; large involucres of Kekchi cotton; opening, or flaring, of bracts avoided; hairy margins of involucral bracts; extent of protection by involucre; advantage of open involucres—Behavior of parasitized buds: Shedding of weevil-infested squares; countings of flared and fallen squares; proliferation of internal tissues of buds; causes and conditions of bud proliferation; proliferation in other varieties—Protection of the bolls: Persistence of flowers; immunity of very young bolls; rapid growth of young bolls; thick-walled bolls; tough linings of chambers of bolls; proliferation from the wall of the boll; time required for proliferation; efficiency of adaptive characters of bolls; bacterial diseases following weevil injuries; breeding in buds a derived habit; relation between proliferation in buds and in bolls—Protection of seeds by lint: Protective seed arrangement in Kidney cotton—Cultural value of Kidney cotton—The nature and causes of adaptations—Conscious and unconscious selection—Summary of adaptations: Classification of adaptations; adaptive characters of different types of cotton—Concluding remarks—Description of plates—Index.

No. 89. Wild Medicinal Plants of the United States. By Alice Henkel, Assistant, Drug-Plant Investigations. 1906. 76 pp. Price, 5 cents.

CONTENTS: Catalogue of common and scientific names of wild medicinal plants, with descriptions, statements as to geographical distribution, parts used, etc.

No. 90. Miscellaneous Papers. * I. The Storage and Germination of Wild Rice Seed. By J. W. T. Duvel, Assistant. II. The Crown-Gall and Hairy-Root Diseases of the Apple Tree. By George G. Hedgcock, Assistant. * III. Peppermint. By Alice Henkel, Assistant. IV. The Poisonous Action of Johnson Grass. By A. C. Crawford, Pharmacologist. 1906. 34 pp., 5 pls., 3 figs. Price, 5 cents.

CONTENTS: The storage and germination of wild rice seed: Introduction—Distribution—Habitat—Germination of the seed—Fall seeding versus spring seeding—Directions for storing the seed—Detailed conditions and results of storage experiments—Packing for transportation—Methods of making germination tests—Effect of temperature on germination—Summary—Description of Plates I and II. The crown-gall and hairy-root diseases of the apple tree: Introduction—Two distinct diseases, crown-gall and hairy-root—Types of apple crown-gall—Effect upon the length of life of the apple tree—Suggestions to nurserymen—Data desired. Peppermint: Description—Countries where grown—Peppermint cultivation in the United States—Cultivation: Conditions injurious to crop—Harvesting and distillation—Description of still—Peppermint oil and menthol—Export of peppermint oil—Prices of peppermint oil. The poisonous action of Johnson grass.

No. 91. Varieties of Tobacco Seed Distributed in 1905–6, with Cultural Directions. By A. D. Shamel and W. W. Cobey. In Charge of Tobacco Breeding Experiments, Laboratory of Plant Breeding. 1906. 40 pp., 9 pls. Price, 5 cents.

CONTENTS: Introduction—Description of varieties: Cigar-wrapper tobaccos; Sumatra; Connecticut Havana; Connecticut Broadleaf; cigar-filler tobaccos; Cuban; Zimmer Spanish; Little Dutch; pipe tobaccos; North Carolina Bright Yellow; Maryland Smoking; plug tobaccos; White Burley; Orinoco and Yellow Mammoth; Virginia types (Blue Pryor, Sun-Cured, and White Stem)—Directions for culture: Sumatra tobacco; Connecticut Havana tobacco; Connecticut Broadleaf tobacco; Cuban tobacco; Zimmer Spanish and Little Dutch tobaccos; Maryland Smoking tobacco; North Carolina, Tennessee, and Virginia tobaccos; White Burley tobacco—Insect enemies—Directions for saving seed—How to secure good seed—Description of plates.

* No. 92. Date Varieties and Date Culture in Tunis. By Thomas H. Kearney, Physiologist, Plant Breeding Investigations. 1906. 112 pp., 10 pls., 52 figs. Price, 25 cents.

CONTENTS: Introduction—Characteristics of the region: Geography; the Jerid; the Nefzaoua; Gabes; Gafsa; climate; temperature; atmospheric humidity; precipitation; irrigation and drainage; water supply; irrigation system; drainage system; soils of the Jerid region; texture; fertility; alkali—Culture of the date palm: Size and value of the gardens; labor and tenantry system; propagation; preparing the land; planting; irrigating; manuring; other cultural methods; pollination and male palms; ripening; harvesting; preserving—Varieties of the date palm in Tunis: Descriptions of the varieties; varieties of primary importance; soft dates; dry dates; varieties of secondary importance; dry dates; soft dates; varieties of minor importance; dry dates; soft dates; varieties imported but not included in the key; varieties included in the key but not imported; descriptive key to the characters of the fruits; synopsis of the groups; key to the varieties—Index—Description of plates.

* No. 93. The Control of Apple Bitter-Rot. By W. M. Scott, Pathologist. 1906. 36 pp., 8 pls., 1 fig. Price, 10 cents.

CONTENTS: Introduction—The disease and its cause: The diseased spots on the apple; the bitter-rot fungus; the mycelium; summer spores; ascospores; germination of the spores; bitter-rot cankers on the branches; source of infection and spread of the disease; influencing conditions; weather; moisture; temperature; susceptibility of different varieties—Remedial measures—The Virginia experiments: The experimental trees; the plan of the experiment; object; spraying scheme; weather conditions attending the experiment; results; beneficial effects of spraying; effect of the treatment on other diseases; scab; leaf-spot; sooty-blotch; injurious effects of the treatment; russeting; coating of Bordeaux mixture—Commercial operations: Results in several orchards—Preparation of Bordeaux mixture—Method of applying Bordeaux mixture—Conclusions and recommendations—Description of plates.

* No. 94. Farm Practice with Forage Crops in Western Oregon and Western Washington. By Byron Hunter, Assistant Agriculturist, Farm Management Investigations. 1906. 39 pp., 4 figs. Price, 10 cents.

CONTENTS: Introduction—Description of the region—Haymaking: Conditions governing stage at which hay should be cut; curing hay; hay caps—The silo—The nature of leguminous plants—Forage crops: Red clover; methods of sowing; the seed crop; alsike clover; common vetch; methods of sowing; soiling; the hay crop; the seed crop; pearl vetch; field peas; alfalfa; methods of sowing; inoculation; timothy; the rye-grasses; orchard grass; meadow fescue; velvet grass; Indian corn; rape; the seed crop; thousand-headed kale; methods of sowing; feeding; the seed crop; root crops; soiling (green feeding) crops—Seeding timber burns and burnt slashings.

No. 95. A New Type of Red Clover. By Charles J. Brand, Assistant Physiologist, Laboratory of Plant Life History. 1906. 48 pp., 3 pls., 2 figs. Price, 10 cents.

CONTENTS: Introduction—The importance of clover culture—Domestic versus foreign seed—Objections of European growers to American red clover—Hairy clover a cause of bloating—Some general objections to the growing of clover—Certain objections overcome by new type of clover—Disadvantage of lateness of maturing under some conditions—Heavy yield of first crop and accruing advantages—Other points of excellence of hairless clover—Effect of persisting basal leaves on quality of hay—Lateness of hairless clover with reference to insect ravages—Effect of lateness of maturing when seed production is desired—Sections particularly suited to the cultivation of the new type—Seed of new type indistiguishable from ordinary form—Plans of experiments, origin of seed, and methods of procedure—Sources of Russian clover seed except No. 16—Source from which Russian seed No. 16 was obtained—The soil and climate of Orel—Purity and germination of seed used in experiments—Detailed description of experiments: The experiment in Nebraska; location; soil; drainage; preparation of land and seeding; general weather conditions during 1904; comparison of strains of clover on entering the winter of 1904; comparison of early growth of certain strains of clover; weather during growing season of 1905; earliness of varieties and order in which they matured; yield of the Orel clover compared with other strains; the experiment in South Dakota; location; soil and drainage; preparation of land, seeding, and subsequent treatment; weather conditions during 1904 and 1905; comparison of yields; the experiment in Minnesota; location, soil, and drainage; preparation of land, seeding, and subsequent treatment; weather conditions during 1904 and 1905; comparative condition of different strains of clover in the spring of 1905; yields of green matter; comparison of clover No. 16 with other strains; yields of field-cured hay; order in which the various strains matured; comparison of yields of field-cured hay; the experiment in North Dakota; location, soil, and drainage; preparation of land, seeding, and subsequent treatment; weather conditions during 1904 and 1905; comparison of yields—Other experiments in which clover No. 16 was included—Description of new type and name proposed—Later observations—Summary—Description of plates.

* No. 96. Tobacco Breeding. By A. D. Shamel and W. W. Cobey, In Charge of Tobacco Breeding Experiments, Plant Breeding Investigations. 1907. 71 pp., 10 pls., 14 figs. Price, 15 cents.

CONTENTS: Introduction—The great variability of tobacco plants—The introduction and acclimatization of varieties—The structure and arrangement of flowers—The necessity for inbreeding—The improvement of the shape of leaves—The modification of the size of leaves—The control of the number of leaves on individual plants—The production of nonsuckering types—The production of early varieties—The improvement of the burning quality—The selection of seed plants: Records of breeding work made in the field; permanent records of breeding work—Methods of saving seed—Seed separation—Disease resistance—A new variety .produced by seed selection: Uncle Sam Sumatra—New varieties produced by hybridization and seed selection: The Cooley Hybrid; the Brewer Hybrid—Description of plates.

* No. 97. Seeds and Plants Imported During the Period from December, 1903, to December, 1905. Inventory No. 11; Nos. 9897 to 16796. 1907. 255 pp. Price, 30 cents.

CONTENTS: Introductory statement—Inventory of seeds and plants imported—Index of common and scientific names.

No. 98. Soy Bean Varieties. By Carleton R. Ball, Agronomist, Grain Investigations. 1907. 30 pp., 5 pls. (including 1 in colors), 2 figs. Price, 15 cents.

CONTENTS: Origin and introduction of the soy bean—Variability—Classification: Key to the varieties—Descriptions of the varieties: Black-seeded group; Buckshot; Nuttall; Kingston; Ebony; Flat King; Riceland; brown-seeded group; Ogemaw; Eda; Baird; Brownie; mottled-seeded group; Hankow; Meyer; green-seeded group; Samarow; Guelph; greenish-yellow-seeded group; Yosho; Haberlandt; Tokyo; yellow-seeded group; Ito San; Manhattan; Butterball; Amherst; Hollybrook; Mammoth—List of synonyms—Distribution numbers—Description of plates.

* No. 99. A Quick Method for the Determination of Moisture in Grain. By Edgar Brown, Botanist in Charge of the Seed Laboratory, and J. W. T. Duvel, Assistant in the Seed Laboratory. 1907. 24 pp., 12 figs. Price, 5 cents.

CONTENTS: Quality of export corn—Causes of deterioration—The percentage basis for moisture determinations—Description of a method for the rapid determination of moisture—Preparation of samples for moisture determination: Taking the bulk sample; taking the sample for the moisture test; size of sample for the moisture test; weighing the sample for the moisture test; grinding the grain unnecessary—Oil for the moisture test: Quality required; quantity required—Description of the apparatus: The evaporating chamber; the condenser; the stand supporting the evaporating chamber and condenser; the distillation flasks; the thermometers; the condenser tubes; the graduated cylinders for collecting and measuring the water—Comparison of results with determinations made in a water oven: Variations in duplicate tests—Summary.

No. 100. Miscellaneous Papers. * I. Cranberry Spraying Experiments in 1905. By C. L. Shear, Pathologist. * II. The Wrapping of Apple Grafts and Its Relation to the Crown-Gall Disease. By Hermann von Schrenk, Special Agent, and George G. Hedgcock, Assistant. III. Garlicky Wheat. By J. W. T. Duvel, Assistant. * IV. Methods of Testing the Burning Quality of Cigar Tobacco. By Wightman W. Garner, Scientific Assistant. * V. The Drug Known as Pinkroot. By W. W. Stockberger, Expert. VI. Orchard Grass. By R. A. Oakley, Assistant Agriculturist. VII. The Effect of Copper upon Water Bacteria. By Karl F. Kellerman, Physiologist, and T. D. Beckwith, Scientific Assistant. VIII. Conditions Affecting Legume Inoculation. By Karl F. Kellerman, Physiologist, and T. R. Robinson, Assistant Physiologist. 1907. 83 pp., 9 pls., 6 figs. Price, 25 cents.

CONTENTS: Cranberry spraying experiments in 1905: Introduction—Spraying and its results—Importance of early applications—Effects of spraying plants when in full bloom—Keeping qualities of sprayed and unsprayed fruit—Cost and recommendations. The wrapping of apple grafts and its relation to the crown-gall disease: Introduction—Account of experiments—Manner of wrapping—Grafts left unwrapped—Results of wrapping: Effect upon the union; effect on crown-gall formation—Recommedations—Suggestions to nurserymen—Summary. Garlicky wheat: Introduction—Wheat containing garlic—Experiments in separating garlic from wheat: Lot A; lot B; lot C—The total cost of drying and cleaning garlicky wheat: The net cost of removing garlic—The effect of the drying on the milling qualities of the grain—The effect of the drying on the vitality of the wheat—Machinery used for drying and cleaning—Summary. Methods of testing the burning quality of cigar tobacco: Introduction—The smoking test—The effects of the filler, the binder, and the wrapper on the burn of the cigar—Testing the capacity for holding fire and the evenness of the burn—Testing the burn of cigar-filler tobacco. The drug known as pinkroot: Introduction—Trade varieties of pinkroot—Identity of chief substitutes—Minor adulterants—Methods of distinguishing pinkroot from its substitutes. Orchard grass: Introduction—Methods of culture: Seeding; mixtures with red clover; mixtures with other grasses; life of meadows—Uses and value: Hay; pasture; seed; harvesting the seed crop; thrashing; handling the aftergrowth; value of the straw; weeds in orchard grass seed fields; other grasses in fields intended for seed—Summary. The effect of copper upon water bacteria: Introduction—Resistance of various bacteria—Effect of carbon dioxid on viability of Bacillus coli and Bacillus typhi—Copper sulphate and filtration. Conditions affecting legume inoculation: Introduction—Use of lime—Effect of soil conditions upon bacteria—Effect of heavy inoculation—Effect of æration—Associative action of bacteria—Summary.

INDEX TO BULLETINS OF THE BUREAU OF PLANT INDUSTRY NOS. 1 TO 100, INCLUSIVE.

Bulletins of which indexes were printed as a part of their contents are not now indexed with the same fullness as others, the reader being referred to the complete indexes to be found in Bulletins Nos. 53, 58, 88, and 92; to indexes of plants (mainly grasses and forage plants) in Bulletins Nos. 9, 12, 15, 38, 59, 68, and 75; to indexes of the common and scientific names of seeds and plants imported in Bulletins Nos. 5, 66, and 97, while Bulletins Nos. 56 and 89 are themselves alphabetical indexes.

Bibliographies covering the subjects treated will be found in Bulletins Nos. 2, 14, 16, 37, 44, 55, 56, 58, 65, and 79.

Wherever a subject is treated practically throughout an entire bulletin, the word *bulletin* follows to indicate this fact. Similarly, *paper* is added to an entry covering a part (advance sheets) of a bulletin subsequently reprinted in complete form.

A

	Bulletin.	Page.
Aecidium tuberculatum, rust	63	27–28
Aeration of soil. *See* Soil.		
Africa, Algeria, agricultural explorations, *bulletin*	80	1–98
Sahara Desert, agriculture without irrigation, *bulletin*	86	1–27
soils, analyses	1	25
South, plant introduction notes, *paper*	25	13–22
Tunis, date varieties and date culture, *bulletin*	92	1–102
See also Algeria, Egypt, Sahara Desert, and Tunis.		
Agaricus campestris and other basidiomycetous fungi, germination of spores, *bulletin*	16	1–43
growing and spawn making, *bulletin*	85	1–60
Agricultural explorations in Algeria, *bulletin*	80	1–98
Agriculture in West Indies, Spain, and the Orient, *bulletin*	27	1–40
without irrigation in the Sahara Desert, *bulletin*	86	1–30
Agropyron rusts	63	15–17
Agrostis, description of genus	68	20–21
species	68	22–55
history of genus	68	15–20
index to species and synonyms	68	61–64
key to species	68	21–22
Mexican species	68	57–59
nomenclature	68	12–14
North American species, *bulletin*	68	1–68
plates made to show technical details	68	14
species excluded	68	55–57
specimens listed	68	14
taxonomy	68	11–12

	Bulletin.	Page.
Alabama, analyses of soils	1	18
Alaska, grass lands of Alaska peninsula and adjacent islands	82	12
Kadiak island	82	11–12
Kenai peninsula	82	13–14
southern coast	82	9–35
Unalaska and neighboring islands	82	12–13
Yakutat plains	82	14–15
land laws	82	29–35
peninsula and adjacent islands, description	82	12
south, cattle raising	82	23–25
choice of location for settlement	82	28–29
climate	82	26–27
desirability as a home	82	26–28
fodder plants, native, abundance	82	16–18
forage crops, cultivable	82	19–20
freights and transportation	82	26
fuel	82	28
garden products	82	27
goat raising	82	21
grass lands, agricultural value	82	16–29
coast, *bulletin*	82	1–38
location	82	11–15
grasses, native, food value	82	18–19
hog raising	82	21
markets available	82	25–26
population	82	25–26
precipitation	82	27
sheep raising	82	22–23
stock raising	82	21–25
temperature	82	26–27
Alcohol, potato	87	10
Alfa in Algeria	80	95–98
Alfalfa, effect of treatment with humus and lime	100	78–79
fields, cultivation of wheat, *paper*	72	5–7
in Algeria	80	79–83
central Texas	13	54–55
Egypt	62	49
Nebraska	59	25–31
Northwestern States	31	15–21
Oregon and Washington, western	94	23–25
inoculation, results	71	46–53
nodule-forming bacteria	94	24–25
Oasis, in central Texas	13	56
sowing, methods	94	23–24
Turkestan, in central Texas	13	55–56
Northwestern States	31	21
Alfilerilla, Arizona	67	53–54
Algæ, different forms, effect of various concentrations of copper sulphate	64	15–20
in water supplies, *bulletin*	64	1–44
	76	1–55
effect of copper, *paper*	100	57–71
sulphate	64	15–44
	76	9–31
		38–55
forms resistant to copper sulphate	76	12
identification of troublesome forms	76	32–37
key for identification	76	35–37
methods for preventing bad effects	64	13–28
	76	38–39
Sedgwick-Rafter method of quantitative determination	76	32–35
trouble widely distributed	64	10–13
key for identification	76	35–37
Chlorophyceæ	76	36–37

	Bulletin.	Page.
Algæ, key for identification Conjugatæ	76	35–36
Schizophyceæ	76	37
killed, cause of bad odor and taste of water	76	13
methods of destroying or preventing growth, *bulletin*	64	1-44
	76	1-55
Algeria, agricultural explorations, *bulletin*	80	1–98
agriculture of the natives	80	52–55
Arabs	80	52
Kabyles	80	52–54
Saharans	80	54–55
alfa	80	95–98
alfalfa	80	79–83
alkali conditions	53	72–99
barley	80	75–76
beans, horse	80	83
berseem	80	83
camels	80	89
carob, or St. John's bread	80	84–85
cattle	80	88
cereals	80	73–77
citrus fruits	80	68–69
clearing and leveling the land	80	48
climate	80	18-29
coast region, crops	80	56–59
humidity	80	22
irrigation	80	31–36
precipitation	80	22–24
soils	80	39–40
saline	80	43–45
temperature	80	19–22
topography	80	14-15
wind	80	24-25
cork	80	94–95
corn, Indian	80	77
crop rotations	80	46–47
crops	80	55–87
dates	80	69–70
desert region, crops	80	59–60
humidity	80	27–28
irrigation	80	36–38
precipitation	80	28–29
soils	80	41-42
saline	80	45–46
topography	80	16–18
donkeys	80	89
economic conditions	80	49–55
fenugreek	80	83
fertilizers	80	47–48
fiber plants	80	86
figs	80	67–68
forage crops	80	77–85
forest products	80	93
forestry	80	90-98
general conditions	80	90-93
fruits	80	60–71
fuel	80	93
goats	80	90
grapes	80	60-64
high plateau or steppe region, climate	80	25
crops	80	59
irrigation	80	36
soils	80	41
topography	80	15–16
historical and political conditions	80	49–50
horses	80	88-89

	Bulletin.	Page.
Algeria, Indian fig	80	85
irrigation	80	29-38
labor on farms	80	50-51
land values	80	50
live stock	80	87-90
mules	80	89
oats	80	76
olives	80	64-66
orchard crops, miscellaneous	80	70-71
palm, dwarf	80	98
perfume plants	80	86-87
plowing	80	48-49
preparation of the land, methods	80	48-49
sheep	80	89-90
soil management	80	46-48
sorghum	80	76-77
sulla	80	83
tan bark	80	95
timber	80	93
tobacco	80	85-86
truck crops	80	71-73
vetches	80	83-84
wheat	80	74-75
Algerian durum wheats, list, with descriptions, *bulletin*	7	1-48
Alkali conditions, Arizona	53	99-101
California	53	101-114
Sahara	53	72-99
Salton Basin	53	101-114
in soils in the Jerid, Tunis	92	36-41
salts, physiological rôle	45	28-35
Almond, gummosis	26	13
Almonds, Jordan	26	10-13
Spanish, *bulletin*	26	1-16
introduction into America	26	13-14
planting and culture	26	12-13
varieties	26	10-12
Alsine graminea, description of seeds	84	33
American, North, species of Agrostis, *bulletin*	68	1-68
Pomological Society, code of nomenclature	56	11-12
varieties of lettuce, *bulletin*	69	1-103
peppers, *bulletin*	6	1-19
vegetables, *bulletin*	21	1-402
Apple, bitter-rot, cause	93	8-15
control, *bulletin*	93	1-36
experiments in controlling disease in Virginia	93	17-28
remedial measures	93	15-17
cold storage, cultural conditions of fruit	48	34-35
experiments, *bulletin*	48	1-66
influence on apple industry	48	9-10
variety catalogue	48	36-62
crown-gall, relation of wrapping grafts, *paper*	100	13-20
types	90	16
grafts, wrapping, relation to crown-gall, *paper*	100	13-20
index to American literature	56	375-383
leaf-spot, effect of Bordeaux mixture	93	27
nomenclature, *bulletin*	56	1-395
authors and publications quoted	56	12-20
scab, effect of Bordeaux mixture	93	26-27
scald, influence of delayed storage	48	30-31
maturity of fruit	48	27-29
temperatures	48	29-30
wrapper	48	31

	Bulletin.	Page.
Apple, scald, nature	48	27
treatment to prevent	48	32–33
varieties most susceptible	48	31–32
sooty-blotch, effect of Bordeaux mixture	93	27
trees, diseases, crown-gall and hairy-root	90	15–17
effect of diseases on life	90	16
varieties, catalogue	56	21–374
Apples, bitter-rot, *bulletin*	44	1–54
cankers	44	29–32
relation to disease	44	32–36
description	44	15–19
distribution	44	15–19
fungus, conidia	44	21–25
life history	44	19–21
name	44	25–29
historical account	44	11–12
literature	44	46–51
remedial measures	44	38–44
spread	44	36–38
keeping quality, effect of cultural conditions	48	23–24
delay in storage	48	19–21
maturity of fruit	48	16–19
package	48	24–25
removal from storage	48	25–26
temperature	48	21–22
wrapper	48	22–23
varieties in cold storage, comparison	48	33–34
variety catalogue of stored fruit	48	36–62
Arizona, alkali conditions	53	99–101
date palm suitable	53	126–133
experiment station, cooperative experiments, *bulletin*	4	1–31
	67	1–62
grasses and forage plants	67	9–62
range improvement, *bulletin*	4	1–31
	67	1–62
investigations, *bulletin*	4	1–31
	67	1–62
ranges, alfilerilla	67	53–54
annual plants	67	54–56
browse plants	67	56–57
brush	67	19–21
cactaceæ	4	19–20
clovers	67	52–53
feed	4	14–23
	67	46–57
production on large experimental tract	67	24–32
forage plants	67	21–24
former conditions	4	10–14
grasses	4	20–23
	67	46–56
hay crops	67	57–58
itinerary of explorations	67	9–10
large inclosure for experiments	67	16–32
legumes	4	18–19
live stock, carrying capacity	67	32–34
plants injuring	67	59–60
pigweed family	67	50–52
plantains	67	15–17
plants found growing	67	24–32
injurious to stock	67	59–60
poisonous	67	59
prairie dogs	67	46
precipitation records	4	30
	67	41–44

	Bulletin.	Page.
Arizona, ranges, questions and answers regarding grazing conditions	4	10–14
saltbushes and their allies	4	17–18
seed planted in experimental tracts	4	25–28
soil	67	18–19
erosion	67	44–46
suggestions for improvement	67	30–31
timber	67	19–21
tracts reserved for experiments	4	23–30
	67	10–32
weeds	67	58–59
seasons	67	38–44
soil	67	18–19
Artichoke, varieties	21	15–16
Arundinaria hindsii	43	32
var. graminea	43	33
japonica	43	31
simoni	43	32
Ash, diseased wood, description	32	11–12 14–17
susceptibility to disease	32	11
white, disease caused by Polyporus fraxinophilus, *bulletin*	32	1–20
Asparagus, varieties	21	16–18
Australia, soils, analyses	1	25
wattle cultivation	51	21–25
Avocado, a salad fruit from the Tropics, *bulletin*	77	1–52
bearing age of tree	77	36
botanical affinities	77	17–18
budded trees superior	61	21
climatic requirements	77	28–29
cultivation	61	20
	77	29
culture	77	27–33
description	77	15–17
diseases	61	32–33
	77	33–34
distribution and time of blooming	61	13–15
fertilizers	61	20–21
forms and varieties	61	28–31
fruit, analyses	77	46–47
cost of production	77	48
description	61	27–28
eating, methods	77	44–46
edible portion	61	27–28
flavor, improvement by selection desirable	77	32
food value	77	46–47
grading and sorting	61	24–25
harvesting	77	37–40
ideal	61	31
improvements desired	77	29–33
marketing	61	23–26
	77	41–44
packing	61	25–26
	77	38–40
picking	61	23
time	77	37
method	77	37–38
seed and seed cavity	61	28
shipping	77	38–40
size desired	77	33
storage, cold	77	40–41
texture, improvement desired	77	32
uniformity desirable	77	30
uses	61	31–32

	Bulletin.	Page.
Avocado, geographical distribution	77	15
types	77	20-27
Costa Rica	77	25-26
Cuba	77	26
Guatemala	77	21-23
Hawaii	77	26-27
Mexico	77	24-25
Porto Rico	77	23-24
history, early records, origin, names, etc	77	10-15
ideal	61	31
in California	77	36
qualities, improvement desired	77	30
Florida, *bulletin*	61	1-36
status	77	35-36
Hawaii	77	35
Porto Rico	77	34-35
West Indies, not native	77	14
life of tree	77	36
literature	61	11-13
Mexican	61	29-30
name	61	10-11
names, common	77	11-13
nursery	61	16-18
orchard, methods of starting	61	15-21
origin and history	77	10-15
propagation, asexual	77	27-28
by seed	77	27
resistance to cold desirable	77	33
season, extension desirable	77	30-31
seed bed	61	16
reduction of size desirable	77	31
seedling trees, variation in fruit	61	21-23
shape of tree	61	28
soil requirements	77	28
top-working trees	61	19-20
transplanting to the field	61	19
varieties	77	18-20
West Indian—South American	61	30
wind breaks and shade trees, suitability	61	15
yield, increase desirable	77	36-37

B

	Bulletin.	Page.
Bacilli, resistance to copper	100	59-64
Bacillus aroideae, bacterium of soft rot of calla lily, *bulletin*	60	1-47
effect of carbon dioxid	60	37-38
different temperatures	60	33-35
diffused light	60	36
direct sunlight	60	36
hydrogen	60	38
nitrogen	60	36-37
on lead acetate	60	31-32
formation of gas	60	30-31
growth in nutrient media	60	16-30
nitrates reduced to nitrites	60	32
thermal death point	60	35
coli, effect of carbon dioxid	100	64-69
copper	64	28-34, 38
	76	38-47
typhi, effect of copper	64	28-34, 37
	76	38-47
		51-55
carbon dioxid	100	64-69
Bacteria, alfalfa	94	24-25
legume inocculation	94	13-14
	100	73-83

	Bulletin.	Page.
Bacteria, legumes, soil inoculation, *bulletin*	71	1–72
nitrogen-gathering, cultures, commercial production	72	23–24
cost	72	25–26
directions for using	72	26–27
inoculation	72	29–30
keeping for future use	72	27–28
methods of increasing	72	26
effect of acids and alkalis	71	29–30
light, heat, and air	71	28–29
moisture	71	30–31
nitrates	71	30
methods of cultivation	71	27–28
using liquid cultures	71	38–39
	72	26–27
nature of organism	71	22–25
results of inoculation	71	43–71
symbiosis or parasitism	71	35
See also Nitrogen.		
pathogenic, effect of copper	64	28–44
	76	38–47
		51–55
sterilization of water with copper sulphate	64	28–38
	76	38–44
Albuquerque, N. Mex	76	39–40
Anderson, Ind	76	44–47
Columbus, Ohio	76	39–40
sterilization of water with metallic copper	76	40–43
sterilization of water with metallic copper, Philadelphia, Pa	76	41–42
soil, associative action	100	82–83
contaminating forms	100	82–83
effect of lime	100	74–76
soil conditions	100	76–79
inoculation for legumes, *bulletin*	71	1–72
paper	72	23–30
results and reports	71	43–71
See also Soil inoculation.		
soft rot of calla lily, *bulletin*	60	1–47
water, effect of copper, *paper*	100	57–71
resistance to copper	100	59–64
See also Copper.		
BALL, CARLETON ROY, bulletin entitled "Johnson grass: Report of investigations made during the season of 1901"	11	1–24
"Soy bean varieties"	98	1–30
Bamboos, Japanese, *bulletin*	43	1–36
characters	43	14–16
edible, culture	43	24–25
general considerations	43	10–14
groves, management	43	21–23
location and soil conditions	43	19–20
profits of culture	43	23–24
propagation	43	16–19
species	43	25–34
Bambusa palmata	43	33
quadrangularis	43	33–34
veitchii	43	33
vulgaris	43	34
Barley in Algeria	80	75–76
Egypt	62	51–54
Barnyard grass in central Texas	13	37–38

	Bulletin.	Page.
Beach grass on Cape Cod	65	24–30
Bean, bush, green-podded, varieties	21	20–33
Lima, varieties	21	19–20
wax-podded, varieties	21	44–53
Metcalf, in central Texas	13	62
mung, nodules produced by inoculation	100	80-81
pole Lima, varieties	21	41–44
varieties	21	33–41
soy, in central Texas	13	62–63
varieties, *bulletin*	98	1–30
velvet, in central Texas	13	64
Beans, horse, in Algeria	80	83
in Egypt	62	54–55
results of inoculation	71	65–67
soy, black-seeded group	98	12–17
brown-seeded group	98	17–19
classification	98	9–12
descriptions of varieties	98	12–27
distribution numbers	98	27–28
green-seeded group	98	20–21
greenish-yellow-seeded group	98	21–23
inoculation	100	77
key to varieties	98	11–12
mottled-seeded group	98	19–20
origin and introduction	98	7–8
results of inoculation	71	67–68
synonyms	98	27
variability	98	8–9
varieties, Amherst	98	25
Baird	98	18–19
Brownie	98	19
Buckshot	98	12–14
Butterball	98	24–25
Ebony	98	15–16
Eda	98	18
Flat King	98	16
Guelph	98	20–21
Haberlandt	98	22
Hankow	98	19–20
Hollybrook	98	25–26
Ito San	98	23–24
Kingston	98	15
Mammoth	98	26–27
Manhattan	98	24
Meyer	98	20
Nuttall	98	14–15
Ogemaw	98	17–18
Riceland	98	16–17
Samarow	98	20
Tokyo	98	22–23
Yosho	98	21–22
yellow-seeded group	98	23–27
velvet, results of inoculation	71	70
BECKWITH, THEODORE DAY, and KELLERMAN, KARL FREDERIC, paper entitled "The effect of copper upon water bacteria"	100	57–71
Beet, garden, varieties	21	53–65
sugar, and mangel-wurzel, varieties	21	65–74
flowers, arrangement	73	19
description	73	12–14
pollination	73	19–21
in Egypt	62	45–46
Kleinwanzleben	25	68–69
single-germ seed, development, *bulletin*	73	1–26
progress in 1904	73	18–22

	Bulletin.	Page.
Beet, sugar, single-germ seed, experiments in Utah	73	18
Washington, D. C	73	16
gathering	73	21
germination and vitality	73	15-16
proportion developed	73	21-22
seed beets in 1903	73	16-17
planting and growth in 1904	73	18-19
selection	73	15
Beggarweed, Florida, in central Texas	13	56-57
Belgium, potato varieties	87	30-31
Bentley, Henry Lewis, bulletin entitled "Experiments in range improvement in central Texas"	13	1-72
Bermuda grass in central Texas	13	38
Berseem, the great forage and soiling crop of the Nile Valley, *bulletin*	23	1-20
growth in Egypt	62	20, 46-49
history	23	9-11
in Algeria	80	83
inoculation, results	71	70
uses	23	11-13 17-19
varieties	23	13-17
Beryllium salts in place of magnesium salts	45	60-63
Bessey, Ernst Athearn, bulletin entitled "Seeds and plants imported * * * Inventory No. 9"	5	1-79
Bibliography of specific subject treated in bulletin	2	87-92
	14	67-70
	16	39-40
	37	38
	44	46-51
	55	61-62
	56	375-383
	58	90-92
	65	36
	79	47-48
Biskra, Algeria, alkali conditions	53	76-78
Bitter-rot of apple, *bulletin*	44	1-54
control, *bulletin*	93	1-36
Black Hills Forest Reserve, "bluing" and "red-rot" of western yellow pine, *bulletin*	36	1-40
Blackleg of potatoes	87	17-18
Black-rot, inoculation of turnips, experiments	29	10-19
methods employed	29	12
symptoms resulting	29	13
technique employed	29	13-15
turnips, effect, *bulletin*	29	1-20
Black stem rust of Agropyron and Elymus	63	15-16
Agrostis	63	17-18
Blepharoplast in Zamia a centrosome ?	2	70-81
Blood and leaf, relation between coloring matter	45	21
Bluegrass, annual, growing and handling	84	14
Canada, characters	84	23, 25 27, 28
description	84	24-25
growing and handling	84	13
in south Alaska	82	17
Kentucky, characters	84	23, 25, 27
description	84	22-23
distribution	19	7
growing and handling	84	12-13
in Nebraska	59	35-36
Northwestern States	31	24

	Bulletin.	Page.
Bluegrass, Kentucky, seed, *bulletin*	19	1–19
adulteration	19	8
curing	19	12–14, 19
harvesting	19	9, 10–12
quality required	19	7–8
source of supply	19	8–9
strippers used	19	11–12
vitality	19	15–18
yield	19	9–10
Texas, description	84	28–29
growing and handling	84	14
in central Texas	13	51–52
Bluegrasses, seeds, *bulletin*	84	1–38
Bluestem, big, in Nebraska	59	38–39
Bluestems in central Texas	13	39, 46
Bluetop in south Alaska	82	16
"Bluing" and "red-rot" of western yellow pine, *bulletin*	36	1–40
Boll-weevil-resistant cotton plants, *bulletin*	88	1–87
selective influence	88	10–11
Bordeaux mixture, effect on apple diseases	93	15–30
for cranberry diseases, *paper*	100	7–12
injury to apples by coating	93	28
russeting	93	27–28
methods of applying	93	32
preparing	93	31–32
BRAND, CHARLES JOHN, bulletin entitled "A new type of red clover"	95	1–48
Bread, durum wheat, baking experiments	70	34–65
chemical and baking tests, remarks	70	60–65
study	70	36–44
experiments of individuals	70	31–34
reports on tests	70	49–60
suitability	3	44–45
use in France	3	45
macaroni wheat	3	44–45
	70	34–65
Breeding potatoes for disease resistance	87	20–39
tobacco, *bulletin*	96	1–71
Brewer Hybrid tobacco	96	66–67
British Columbia, analyses of soils	1	20
Broccoli, varieties	21	74–75
Brome-grass, awnless	31	22–23
in Nebraska	59	23–25
smooth, in central Texas	13	50
western, in Nebraska	59	40
BROWN, EDGAR, paper entitled "Legal and customary weights per bushel of seeds"	51	27–34
"The germination, growing, handling, and adulteration of bluegrass seeds"	84	9–14
and DUVEL, JOSEPH WILLIAM TELL, bulletin entitled "A quick method for the determination of moisture in grain"	99	1–24
PIETERS, ADRIAN JOHN, bulletin entitled "Kentucky bluegrass seed: Harvesting, curing, and cleaning"	19	1–19
SCOFIELD, CARL SCHURZ, bulletin entitled "Wild rice: Its uses and propagation"	50	1–24
Brush, Arizona	67	19–21
Brussels sprouts, varieties	21	75–76
Buckhorn seeds, description	84	35
Budding the fig, loquat, and mango	46	8–19
pecan, *bulletin*	30	1–20

	Bulletin.	Page.
Buffalo grass in central Texas	13	39
Nebraska	59	40
Bulbs, directions for planting	25	47
Buried seeds, vitality experiments, *bulletin*	83	1–20
Burma, Lower, agricultural conditions	35	35
Burnet, varieties	21	76
Burning quality of cigar tobacco, methods of testing, *paper*	100	31–40
Burnt slashings in western Oregon and Washington, seeding	94	39

C

Cabbage, varieties	21	76–103
Cacti, economic, distribution in United States	74	11–12
miscellaneous uses	74	40–41
species of value as forage	74	37–38
prickly pear, etc., as food for live stock, *bulletin*	74	1–48
Calcium salts, effect on plants	1	16–17
physiological rôle	45	35–70
replaced by strontium	45	46–49
California, alkali conditions	53	101–121
avocado growing	77	36
date palm suitable	53	122–125
interior valley, description	31	13
northeastern, forage conditions, *bulletin*	38	1–52
northwestern, agricultural subdivisions	12	11–13
bottom lands	12	54–56
chaparral	12	31–32
climatology	12	14–15
coast-bluff belt	12	49–62
fodder crops	12	64–73
fungous parasites	12	74–76
grasses, forage crops, etc., index	12	79–81
interior plateau region	12	16–49
itinerary of investigations	12	15–16
mesa lands	12	50–52
mountain valleys	12	16–24
open, summer, or annual ranges	12	25–27
physical features	12	11–15
phytographic notes	12	76–77
poisonous plants	12	73–74
prairies	12	27–28 52–54
range conditions	12	16–63
deterioration	12	38–43
improvement	12	48–49
preservation	12	43–46
renewal	12	46–48
rotation and management	12	33–34
soils	12	17–18 25, 55
redwood belt	12	62–63
sand dunes	12	58–62
stock ranges, *bulletin*	12	1–81
subalpine meadows	12	32–33
topography	12	13–14
upland ranges	12	24–25
woodland or winter range	12	28–31
temperatures	85	51
See also Salton Basin.		
Calla lily, soft rot, *bulletin*	60	1–47
Camels in Algeria	80	89
Camomile, scentless, description of seeds	84	34
Canada thistle, description of seeds	84	33–34
Canary grass, reed, in Nebraska	59	41

	Bulletin.	Page.
Cape Cod sand dunes, reclamation, *bulletin*	65	1-38
of Good Hope, seedling grape varieties	25	14-16
Carbon dioxid, effect on Bacillus coli and Bacillus typhi	100	64-69
Cardoon, varieties	21	104
CARLETON, MARK ALFRED, bulletin entitled "Investigations of rusts"	63	1-32
"Macaroni wheats"	3	1-62
and CHAMBERLAIN, JOSEPH SCUDDER, bulletin entitled "The commercial status of durum wheat"	70	1-70
Carnallit, action on crops	1	12
Carob in Algeria	80	84-85
Carrots in western Oregon and Washington	94	35-37
varieties	21	104-116
Cascade Mountains, farm practice in territory to the west, *bulletin*	94	1-39
Castilla and trumpet tree, comparison	49	29
botanical study	49	18-31
culture	49	48-62
clean cultivation	49	56
clearing land	49	55-56
distance between trees	49	54-55
profits and prospects	49	76-84
propagation from cuttings	49	59-60
seed beds and nurseries	49	58-59
seeds, handling	49	56-58
shade	49	48-54
description	49	19-23
habits in wild state	49	28-29
Hooker's monograph	49	23-24
in Costa Rica	49	24-25 43-44
Guatemala	49	25-28
India	49	45
Mexico	49	25-28
Nicaragua	49	43
latex extraction	49	62-69
not a forest tree	49	30-31
on Isthmus of Panama	49	44
Porto Rico, suitability	49	17
productiveness	49	74-76
rubber culture, status	49	13-18
industry, extent	49	16
shade tree	49	60-62
species and varieties	49	23-27
tapping	49	62-68
versus Hevea	49	14
Cattle, fattening and maintaining on prickly pear	74	24-29
in Algeria	80	88
raising in South Alaska	82	23-25
Cauliflower, varieties	21	116-123
Celeriac, varieties	21	123-124
Celery, varieties	21	124-132
Cell, central, in Zamia	2	39-48
fecundated egg in Zamia	2	69-70
Cells, evolution	81	9-26
Cellular structures, evolution, *bulletin*	81	1-26
Central American rubber tree, culture, *bulletin*	49	1-86
Centrosome in Zamia	2	70-81
Cereals in Algeria	80	73-77
See also Corn, Oats, Sorghum, and Wheat.		
Ceylon, agricultural conditions	35	21-22
CHAMBERLAIN, JOSEPH SCUDDER, and CARLETON, MARK ALFRED, bulletin entitled "The commercial status of durum wheat"	70	1-70
Cheat in Northwestern States	31	25

	Bulletin.	Page.
Chegga, Algeria, alkali conditions	53	84–88
Chervil, varieties	21	132
Chess and rescue grass, seeds, *paper*	25	5–8
Chestnut tree, lime and magnesia content	1	30
Chick-peas in central Texas	13	61–62
Egypt	62	61
Chickweed, common, description of seeds	84	32–33
mouse-ear, description of seeds	84	32
Chicory, varieties	21	133
China, agricultural conditions	27	22–27
	35	37–40
rice, cultivation	35	39
hulling and milling	35	39–40
Chives, varieties	21	133
Chlorids, absorption by aquatic plants	45	26
beneficial and injurious action	45	25–26
Chloris rust	63	18
Cholera, Asiatic, effect of copper	64	34–36
	76	51–54
Chufas, varieties	21	133
Cigar tobacco, methods of testing the burning quality, *paper*	100	31–40
Circulars, congressional seed and plant distribution, 1902–1903	25	23–82
Citrus fruits in Algeria	80	68–69
and trees, diseases, *bulletin*	52	1–22
remedial measures	25	17–19
varieties attacked	52	11
Clover, alsike, in central Texas	13	57
western Oregon and Washington	94	17–18
bur, in central Texas	13	57–58
crimson, results of inoculation	71	69
culture, importance	95	10
Egyptian, berseem, *bulletin*	23	1–20
mammoth, in central Texas	13	58
red, hairless Orel, description and name proposed	95	41–42
experiments	95	17–18 22–41 42–44
insect injuries	95	15–16
lateness of maturing	95	13, 15, 16
persisting basal leaves	95	14–15
plans of experiments	95	17–18
points of excellence	95	13–14
sections suited to growth	95	16
seed, germination	95	21–22
indistinguishable from ordinary form	95	16–17
production	95	16
purity	95	21–22
used in experiments, origin	95	17–18
source from which obtained	95	19
of other Russian seed	95	18–19
yield	95	13
hairy, cause of bloating	95	12
in central Texas	13	58–59
western Oregon and Washington	94	14–17
inoculation	71	53–57
	100	77
methods of sowing	94	15–16
mixtures with orchard grass	100	47–48
new type, *bulletin*	95	1–48
objections of European growers to American clover	95	11
to growing	95	12
overcome by new type	95	12–13

	Bulletin.	Page.
Clover, red, Russian, *bulletin*	95	1–48
in central Texas	13	59
seed crop	94	17
domestic versus foreign	95	11
sown with wheat, oats, or rape	94	15–16
sweet, in central Texas	13	59–60
white, in central Texas	13	60
Clovers in Arizona	67	52–53
Nebraska	59	34–35
Nevada and Oregon	15	45–46
Northwestern States	31	23–24
Texas, central	13	57–60
COBEY, WILLIAM WILFRED, and SHAMEL, ARCHIBALD DIXON, bulletin entitled—		
"Tobacco breeding"	96	1–71
"Varieties of tobacco seed distributed in 1905–6, with cultural directions"	91	1–40
Cocklebur rust	63	26
Cold, effect on yield of wheat	78	100–104
storage, apple, *bulletin*	48	1–66
pear and peach, *bulletin*	40	1–28
Collards, varieties	21	133–134
Collection of economic and other fungi for distribution, *bulletin*	8	1–31
Colletotrichum gloeosporioides, description	52	16
diseases caused	52	9–20
distribution	52	9–10
method of attack	52	10–11
COLLINS, GUY N., bulletin entitled "The avocado, a salad fruit from the Tropics"	77	1–52
"The mango in Porto Rico"	28	1–38
Colorado grass in central Texas	13	39–40
Columbia, Mo., experiments in mushroom growing	85	39–48
Commercial grading of corn, *bulletin*	41	1–24
status of durum wheat, *bulletin*	70	1–70
Community demonstration farm at Terrell, Tex., *paper*	51	9–14
corn	51	13–14
cotton	51	12–13
description	51	11
fertilizers used	51	11–12
methods employed	51	10–11
results accomplished	51	10
Compost for mushroom growing	85	33–36
Condenser tubes used in moisture determinations of grain	99	20
used in moisture determinations of grain	99	18–19
Conditions affecting legume inoculation, *paper*	100	73–83
Congressional seed and plant distribution, allotment and plan	25	23–26
circulars, 1902–1903	25	23–82
Control of apple bitter-rot, *bulletin*	93	1–36
COOK, ORATOR FULLER, bulletin entitled "The culture of the Central American rubber tree"	49	1–86
"Weevil-resisting adaptations of the cotton plant"	88	1–87
and SWINGLE, WALTER TENNYSON, bulletin entitled "Evolution of cellular structures"	81	1–26
Cooley Hybrid tobacco	96	64–66
Copper as an algicide and disinfectant in water supplies, *bulletin*	76	1–55
colloidal solutions	64	36–39

	Bulletin.	Page.
Copper, effect upon cholera germs	64	34–36, 38
paracolon	64	38
paratyphoid	64	38
pathogenic bacteria	64	28–34
	76	38–54
typhoid germs	64	28–34
		37–39
	76	38–54
water bacteria, *paper*	100	57–71
metallic, for sterilizing water	76	40–43
resistance of various water bacteria	100	59–64
sulphate and filtration	100	69–71
comparison with other disinfectants	64	35
cost of treatment	64	43
difference in toxicity in laboratory and field conditions	76	9–10
effect on algæ	64	15–20
		26–29
	76	9–31
		38–55
animal life	64	20–21
fish	64	20
	76	11–12
man	64	21–25
	76	48–54
for water supplies, *bulletin*	64	1–44
	76	1–55
assistance of Department of Agriculture	64	42
effect of treatment, reports	76	13–31
Baltimore, Md	76	14–15
Bond Hill, Cincinnati, Ohio	76	15
Butte, Mont	76	15–17
Cambridge, N.Y.	76	17–18
Elmira, N. Y.	76	18–19
Fieldhome, N. Y.	76	19
Glencove, L. I., N. Y	76	19–20
Greenwich, Conn	76	20
Hanover, N. H.	76	20–22
Hanover, Pa	76	22
Ivorydale, Ohio	76	22
Johnson Creek, Wis	76	22
Middletown, N.Y.	76	22–24
Millersburg, Pa.	76	25
Moncton, N. B.	76	25–26
New York, N. Y.	76	26
Newtown, Pa	76	26–27
Oberlin, Ohio	76	27
Passaic, N. J.	76	28
Port Deposit, Md	76	28
Rhinebeck, N. Y.	76	28
Scarboro, N. Y.	76	28–29
Springfield, Ill	76	29
Waltham, Mass.	76	29
Water Mill, L. I., N. Y.	76	29–30
Wellsboro, Pa	76	30
Winchester, Ky.	76	30–31
Winnebago City, Minn	76	31

	Bulletin.	Page.
Copper sulphate for water supplies, effects	64	15–44
	76	9–31
		38–55
eradication of algæ	64	26–27
	76	9–31
filtration necessary	64	41–42
	76	43–44
knowledge of polluting organism necessary	64	40–41
	76	31–32
method of application	64	25–26
	76	38
opinions of toxicologists	76	48–51
quantity necessary to eradicate algæ	64	15–20
	76	12
sterilizing bacteria-polluted water	76	38–40
tests of method	64	26-28
	76	13–31
objections to use	76	48
use in filters	76	43–44
medicine	64	42
	76	51–54
sewage disposal	76	43
See also Bacteria.		
Cork in Algeria	80	94-95
Corn, apparatus for measuring elements	41	16–17
causes of deterioration in transit or storage	99	7-8
classes and grades	41	18-20
deterioration	41	20-23
determination of elements	41	17-18
elements essential in grading	41	15-16
export, quality	99	7
field, varieties	21	134-149
grades	41	18-20
local and special	41	22-23
grading, commercial, *bulletin*	41	1-24
in Algeria	80	77
Egypt	62	49-51
Nebraska	59	48–49
Oregon and Washington, western	94	29–30
inspection	41	10
certificates	41	20
parasite, rooi-bloem	25	18-20
pop, varieties	21	149-151
quick method of determining moisture, *bulletin*	99	1-24
salad, varieties	21	165
sweet, varieties	21	151-164
water content	99	7-24
Costa Rica, avocados	77	25-26
Castilla species	49	24-25
Cotton, Allen Improved	25	52-53
Excelsior	25	51
Griffin	25	53-55
Guatemalan varieties	88	7-74
in Egypt, cultivation	62	16-42
distance between beds	62	20-22
exports	62	42
fertilizing	62	26-33
irrigating	62	23-26
manuring	62	26-33
marketing	62	39–41
picking	62	39
planting	62	22-23

	Bulletin.	Pag
Cotton, in Egypt, plowing	62	18-20
seed exports	62	42
selection	62	38-39
sowing	62	22
varieties	62	33-38
Abbasi	62	36-37
Ashmouni	62	38
Jannovitch	62	37-38
Mit Afifi	62	35-36
watering	62	23-26
JOHN STORRS, bulletin entitled "Range management in the State of Washington"	75	1-28
Jones Improved	25	49-50
Kekchi, dwarf habit, etc	88	11-28
involucres, etc	88	39-42
protection of bolls	88	51-65
Kidney, cultural value	88	67
seed arrangement	88	66-67
King	25	51-52
long-staple Upland varieties	25	56-57
Parker	25	50-51
plant, buds, proliferation	88	46-51 58-61
conscious and unconscious selection	88	70-72
extrafloral nectaries	88	28-37
involucre as a protective structure	88	37-43
nature and causes of weevil-resisting adaptations	88	67-70
parasitized buds, behavior	88	43-51
protection of bolls	88	51-65
protective characters	88	11-28
seeds, protection by lint	88	65-67
weevil-resisting adaptations, *bulletin*	88	1-87
Rivers	25	55, 59-63
directions for planting and picking	25	61-62
history	25	59-61
Seabrook	25	55
Sea Island No. 224	25	64-65
varieties	25	55, 57
seed, distribution in 1903	25	47
pure, how to grow	25	58
short-staple Upland varieties	25	56
top grass in central Texas	13	40
wilt, control	25	61
description	25	61
Cottonwood rusts	63	18-19
Cowpea, diseases	25	67-68
in Nebraska	59	47-48
Iron, circular containing description, etc	25	65-68
characters	25	66
directions for planting	25	66
history	25	65-66
root-knot	25	67-68
description	17	23-24
resistant variety	17	31-35
some diseases, *bulletin*	17	1-38
wilt, cause	17	10-12
description of disease	17	9-10
fungus	17	11
distribution	17	13
infection and spread	17	11-12
loss	17	13-15
preventive measures	17	15-20
experiments	17	16-20
rotation of crops	17	15

	Bulletin.	Page.
wpea, wilt, preventive measures, substitution of crops	17	15-16
relation to other diseases	17	12
wpeas in central Texas	13	60-61
results of inoculation	71	58-61
ws fed on prickly pear, milk production	74	20-24
milch, experiments with silage alone	82	20-21
ab-grass in central Texas	13	41
anberries in full bloom, effect of spraying	100	10
keeping qualities of sprayed and unsprayed fruit	100	10-11
anberry spraying experiments in 1905, *paper*	100	7-12
AWFORD, ALBERT CORNELIUS, paper entitled "The poisonous action of Johnson grass"	90	31-34
ress beds, eradication of algæ	64	26-27
	76	48
varieties	21	166-167
ross-pollination, methods	96	20-21
rown-gall and hairy-root diseases of the apple tree, *paper*	90	15-17
formation, effect of wrapping	100	18
relation of wrapping of apple grafts, *paper*	100	13-20
uba, avocados	77	26
uban-grown tobacco, supply	96	13-14
ucumber, varieties	21	167-182
ultivated forage crops of the Northwestern States, *bulletin*	31	1-28
ultivation of the Australian wattle, *paper*	51	21-25
wheat in permanent alfalfa fields, *paper*	72	5-7
ultural directions, tobacco	91	15-34
ulture of the Central American rubber tree, *bulletin*	49	1-86
ylinders, graduated, used in moisture determinations of grain	99	20-21

D

Dairy rations, prickly pear	74	20-24
Dandelion seeds, description	84	34
varieties	21	182-183
Darwin's investigations of cross and self fertilization	96	22, 25
Date culture by ancients	53	17
feasibility for United States	53	139-140
in Algeria	80	69-70
Mexico, competition	53	134-136
Sahara	86	18-26
Tunis	92	41-55
on Persian Gulf, *bulletin*	54	1-32
profits	53	136-138
	54	28-29
gardens of Oued Souf, Sahara Desert	86	18-26
care of palms	86	21
harvest	86	24-25
manuring	86	22-24
planting	86	19-21
sand encroachment	86	22
varieties grown	86	25-26
yield	86	25
Tunis, irrigating	92	47-48
manuring	92	49-50
planting	92	46-47
preparation of soil	92	45
size and value	92	41-42
on Persian Gulf, irrigation	54	14-19
location	54	11-13
planting	54	19-20
secondary cultures	54	19
soil	54	13-14
treatment	54	19-20

	Bulletin.	Page
Date palm and its utilization in the Southwestern States, *bulletin*	53	1-15
cultural methods in Sahara	86	18-25
Tunis	92	41-5
on Persian Gulf	54	14-2
heat requirements	53	58-70
humidity and rain, effects	53	52-5
male trees and pollination	92	50-51
manuring	92	49-5
propagation in Tunis	92	43-4
types	53	30-31
varieties, Algeria	80	69-70
and date culture in Tunis, *bulletin*	92	1-112
Deglet Noor	53	33-36
Khalas	53	36-37
ordinary	53	38
Persian Gulf	54	21-27
Sahara Desert	53	41-47
	86	25-26
sorts suitable for introduction	53	31-43
Dates as food	54	30
gathering, curing, and packing	53	29-30
heat required to mature	53	65-70
in Algeria	80	69-70
market	53	13
packing and shipment	54	29-30
Persian Gulf, *bulletin*	54	1-32
DAVY, JOSEPH BURTT, bulletin entitled "Stock ranges of northwestern California: Notes on the grasses and forage plants and range conditions"	12	1-81
Decay of timber and methods of preventing it, *bulletin*	14	1-96
Demonstration farm, Terrell, Tex., *paper*	51	9-14
Denmark, sand fixation	57	25-27
Description of wheat varieties, *bulletin*	47	1-18
Determinations, moisture, of grain	99	7-24
Development of single-germ beet seed, *bulletin*	73	1-26
Disease, mosaic, tobacco, observations, *bulletin*	18	1-24
resistance of potatoes, *bulletin*	87	1-39
tobacco	96	60-62
tobacco wilt and its control, *paper*	51	5-8
Diseases, almond, gummosis	26	13
apple, bitter-rot, *bulletin*	44	1-54
control, *bulletin*	93	1-36
crown-gall, types	90	16
leaf-spot	93	27
scab	93	26-27
scald	48	26-33
sooty-blotch	93	27
tree, crown-gall and hairy-root, *paper*	90	15-17
ash, white, *bulletin*	32	1-20
avocados	77	33-34
bacterial, black-rot of turnips, *bulletin*	29	1-20
Bermuda or Easter lily	39	11-15
black-rot, effect on turnips, *bulletin*	29	1-20
citrus trees and fruits, *bulletin*	52	1-22
cowpea, *bulletin*	17	1-38
cranberry, spraying experiments in 1905, *paper*	100	7-12
crown-gall of apple, relation of wrapping of apple grafts, *paper*	100	13-20
dry-rot of potatoes, *bulletin*	55	1-62
fungous, western yellow pine, *bulletin*	36	1-40
lily, calla, soft-rot, *bulletin*	60	1-47
Easter	39	11-15
mango	28	20-21
pine tree, western yellow, *bulletin*	36	1-40
potato, blackleg	87	17-18

	Bulletin.	Page.
iseases, potato, filosité, or growing-out	87	13
internal brown-spot	87	12–13
late-blight	87	19–28
leaf-spot	87	13–14
scab and scablike diseases	87	14–17
potatoes, disease resistance, *bulletin*	87	1–39
rusts, investigations, *bulletin*	63	1–32
soft rot of calla lily, *bulletin*	60	1–47
tobacco, mosaic, *bulletin*	18	1–24
wilt and its control, *paper*	51	5–8
turnips, black-rot, *bulletin*	29	1–20
western yellow pine, "bluing" and "red-rot," *bulletin*	36	1–40
istillation flasks used in moisture determination of grain	99	19–20
ock, curled, description of seeds	84	36
onkeys in Algeria	80	89
rainage system in the Jerid, Tunis	92	33
rug known as pinkroot, *paper*	100	41–44
plants, wild, of the United States, *bulletin*	89	1–76
See also Golden seal and Peppermint.		
ry-rot of potatoes due to Fusarium oxysporum, *bulletin*	55	1–62
UGGAR, BENJAMIN MINGE, bulletin entitled "The principles of mushroom growing and mushroom spawn making"	85	1–60
unes sand, Cape Cod, accumulations of sand	65	15–17
beach grass, condition of plantings	65	27–28
cost of planting	65	27
efficiency for sand binding	65	28–30
selecting and transplanting sets	65	26–27
time of planting	65	25–26
utilization	65	25–30
bibliography	65	36
brush laying	65	28
deposition of sand	65	12–13
devastation of dune areas	65	18–20
legislation to prevent	65	20–21
development of dune range	65	13–14
marshes and bogs	65	17–18
protective beach ridge	65	34
forest area	65	18
forestation necessary	65	30–31
lands, value	65	35
province lands, State ownership	65	34
rainfall	65	11–12
reclamation, *bulletin*	65	1–38
artificial	65	21–34
natural	65	14–15
small areas	65	32–33
road construction	65	32
sand control, early work	65	21–23
recent work	65	24–31
utilization	65	33–34
vegetation, ecological relations	65	10–18
work by State in reclamation	65	24–31
controlling and reclaiming methods, *bulletin*	57	1–36
fixation	57	13–21
by forestation	57	21
grasses	57	14–19
heather	57	19–20
hedges	57	20
in Denmark	57	25–27
Europe	57	22–31
France	57	29–31

	Bulletin.	Page.
Dunes, sand, fixation in Germany	57	27–29
Massachusetts	65	1–38
Netherlands	57	22–25
formation	57	9–13
Durum wheat, Algerian varieties, *bulletin*	7	1–48
commercial status, *bulletin*	70	1–70
macaroni wheats, *bulletin*	3	1–62
See also Macaroni and Wheat.		
DUVEL, JOSEPH WILLIAM TELL, bulletin entitled—		
"The vitality and germination of seeds"	58	1–96
"The vitality of buried seeds"	83	1–22
paper entitled—		
"Garlicky wheat"	100	21–30
"The storage and germination of wild rice seed"	90	5–14
and BROWN, EDGAR, bulletin entitled "A quick method for the determination of moisture in grain"	99	1–24

E

	Bulletin.	Page.
Earth's crust, lime and magnesia content	1	13
Effect of black-rot on turnips, *bulletin*	29	1–20
copper upon water bacteria, *paper*	100	57–71
Eggplant, varieties	21	183–187
Egypt, agriculture, notes, *bulletin*	62	1–61
alfalfa, or lucern	62	49
beans	62	54–55
beets, sugar	62	45–46
berseem, cultivation	23	9–19
	62	20, 46–49
chick-peas	62	61
corn	62	49–51
cotton	62	16–42
fenugreek	62	61
flax	62	61
irrigation and fertilizers	62	9–13
labor	62	14–15
of animals	62	15–16
land, value	62	15
lentils	62	60
lupines	62	61
millets	62	59–60
Nile River mud, composition	62	9
onions	62	58–59
peanuts, or earth nuts	62	60–61
rice	62	55–58
seasons	62	16
soils	62	13–14
sorghums	62	59–60
sugar cane	62	42–45
wheat and barley	62	51–54
Elymus rusts	63	15–17
virginicus in Nebraska	59	41
Endive, varieties	21	187–189
Ensilage	94	11–13
prickly pear	74	35–36
Enzyms in seeds	58	82–87
Eragrostis in Nebraska	59	41
Ergot in bluegrass seeds, description	84	38
Euphorbia rust	63	9–11
Europe, potato culture	87	9–12
disease-resistant varieties	87	28–31

	Bulletin.	Page.
Europe, potato diseases	87	12–19
Evaporating chamber used in moisture determinations of grain	99	13–19
Everlasting grass in central Texas	13	42
Evolution of cells, alternation of types	81	13–15
elimination of simple-celled phase	81	12-13
heredity in reticular descent	81	20–22
sexuality a mechanism of evolution	81	15–16
types of double-celled structures	81	16–20
cellular structures, *bulletin*	81	1–26
Experiment station work, potatoes	87	31–36
stations, cooperation in testing grasses and forage palnts	10	8–11
Experimental study of the relation of lime and magnesia to plant growth, *paper*	1	37–53
Experiments, cooperative, with grasses and forage plants, and records of seed distribution, *bulletin*	10	1–23
in range improvement in central Texas, *bulletin*,	13	1–72.
Explorations, foreign, recent, *bulletin*	35	1–44
Explorers, agricultural, results accomplished	66	8–9
Extermination of Johnson grass, *paper*	72	15–22

F

	Bulletin.	Page.
Fairchild, David Grandison, bulletin entitled—		
"Berseem: The great forage and soiling crop of the Nile Valley"	23	1–20
"Japanese bamboos and their introduction into America"	43	1–36
"Letters on agriculture in the West Indies, Spain, and the Orient"	27	1–40
"Persian Gulf dates and their introduction into America"	54	1–32
"Spanish almonds and their introduction into America"	26	1–16
"Three new plant introductions from Japan"	42	1-24
paper entitled—		
"Cultivation of wheat in permanent alfalfa fields"	72	5–7
"Plant introduction notes from South Africa"	25	13–22
"Saragolla wheat"	25	9–12
"The cultivation of the Australian wattle"	51	21–25
statement as to results accomplished in introduction of foreign seeds and plants	66	7–9
Farm practice with forage crops in western Oregon and western Washington, *bulletin*	94	1–39
Fecundation process in Zamia	2	63–69
Feeding crops, green	94	38
Fennel, dog, description of seeds	84	35
Fenugreek in Algeria	80	83
Egypt	62	61
Ferguson, Margaret Clay, bulletin entitled "A preliminary study of the germination of the spores of Agaricus campestestris and other basidiomycetous fungi"	16	1–43
mushroom germination investigations	85	13–15
Fertilizers, manure for mushroom growing	85	23–31 33–36

	Bulletin.	Page.
Fescue, meadow, in Nebraska	59	31–32
western Oregon and Washington	94	27–28
Siberian, in south Alaska	82	17
Fiber plants in Algeria	80	86
Fig, propagation	46	17–19
Figs in Algeria	80	67–68
Filosité of potatoes	87	13
Filters, supplementary use of copper	76	43–44
Filtration, water, and copper sulphate	100	69–71
Flasks, distillation, used in moisture determinations of grain	99	19–20
Flax in Egypt	62	61
Florida, avocado, cultivation, etc	61	9–33
	77	35–36
Flour and bread, durum wheat, chemical and baking tests, remarks	70	60–65
study	70	36–44
color	70	62–63
tests, reports	70	49–60
durum wheat, chemical analyses	70	36–42
Flowers, calla lily, soft rot, *bulletin*	60	1–47
Easter lily, propagation from seed, *bulletin*	39	1–24
tobacco, structure and arrangement	96	17–21
Fluorids in physiological relations	45	26–27
FOADEN, GEORGE P., bulletin entitled "Notes on Egyptian agriculture"	62	1–61
Fodder crops, northwestern California	12	64–73
Food for live stock, prickly pear and other cacti, *bulletin*	74	1–46
value of avocado	77	46–47
Forage, berseem, or Egyptian clover, *bulletin*	23	1–20
conditions on the northern border of the Great Basin, *bulletin*	15	1–60
crops, cultivated, Northwestern States, *bulletin*	31	1–28
in Algeria	80	77–85
Nebraska, *bulletin*	59	1–64
western Oregon and western Washington, *bulletin*	94	1–39
suited for cultivation in south Alaska	82	19–20
plants, Arizona	67	21–24
classification	59	18–23
miscellaneous, in central Texas	13	65–72
Nevada and Oregon	15	42–55
on alkaline soils	15	20
prickly pear and other cacti, *bulletin*	74	1–48
problems, lines of investigation undertaken	10	8–9
Forest fires in western Oregon and Washington, seeding burned areas	94	39
products, etc. *See* Pine, Railroads, Timber, and Wood.		
Forestation of sand dunes	57	21
Forestry in Algeria	80	90–98
Formation of the spores in the sporangia of Rhizopus nigricans and of Phycomyces nitens, *bulletin*	37	1–40
Fougala, Algeria, alkali conditions	53	78–84
France, potato varieties	87	30–31
sand fixation	57	29–31
Fruit, apple, nomenclature, *bulletin*	56	1–395
bearing hedge plants	25	16–17
peach and pear, cold storage, *bulletin*	40	1–28
setting without pollination, *bulletin*	22	1–48
trees frozen in 1904, *paper*	51	15–19
tropical, propagation, *bulletin*	46	1–28
Fruits, apple, bitter-rot, *bulletin*	44	1–54
control, *bulletin*	93	1–36
avocado, *bulletin*	77	1–52
in Florida, *bulletin*	61	1–36
citrus, diseases, *bulletin*	52	1–22

	Bulletin.	Page.
Fruits, cranberry spraying experiments in 1905, *paper*	100	7–12
date varieties and date culture in Tunis, *bulletin*	92	1–112
dates, *bulletin*	53	1–155
Persian Gulf, *bulletin*	54	1–32
fig, propagation	46	17–19
grape must, unfermented, *bulletin*	24	1–19
in Algeria	80	60–71
Fulton, Sanford Hamilton, and **Powell, George Harold**, bulletin entitled—		
"Cold storage, with special reference to the pear and peach"	40	1–28
"The apple in cold storage"	48	1–66
Fungi, collection for distribution, *bulletin*	8	1–31
conditions of growth	16	30–33
germination of the spores of Agaricus campestris and other basidiomycetous fungi, *bulletin*	16	1–43
mushroom growing and spawn making, *bulletin*	85	1–60
nomenclature	8	7–31
species of mushrooms cultivated in experiments	85	19–23
spore germination, bibliography	16	39–40
effect of acids	16	20–21
and alkalis	16	21
age of spores	16	21–22
light	16	21
mycelium	16	26–28
substances tested	16	28–30
experiments	16	13–30
historical review of investigations	16	33–38
methods used	16	12–13
new factors	16	22–26
Fungicides, Bordeaux mixture for cranberries, *paper*	100	7–12
Fungous diseases, citrus trees and fruits, *bulletin*	52	1–22
Fungus, apple bitter-rot, *bulletin*	44	1–54
control, *bulletin*	93	1–36
"blue," on western yellow pine	36	15–26
color	36	24–26
dissemination of spores	36	24
effect on toughness of wood	36	20
fruiting organs	36	22–23
growth in artificial media	36	23–24
relation to beetle holes	36	20–22
Fusarium oxysporum, dry-rot of potatoes, *bulletin*	55	1–26
Polyporus fraxinophilus, on white ash, *bulletin*	32	1–20
Fusarium oxysporum, culture media	55	55–59
description	55	27–51
distribution	55	51–52
dry-rot of potatoes, *bulletin*	55	1–62
growth	55	34–49
name	55	50–51
remedial measures	55	52–54

G

	Bulletin.	Page.
Gabes, geography	92	19–20
Gafsa, geography	92	20–21
Gama grass in central Texas	13	43
Garlic in wheat, cost of removal	100	26–28
experiments in removal	100	22–26
loss entailed	100	21–22
quantity before and after treatment	100	26
varieties	21	190
Garlicky wheat, *paper*	100	21–30
Garner, Wightman Wells, paper entitled "Methods of testing the burning quality of cigar tobacco"	100	31–40
Germany, analyses of soils	1	22
potato varieties	87	30
sand fixation	57	27–29

	Bulletin.	Page.
Germination and vitality of seeds, *bulletin*	58	1–96
of mushroom spores	85	12–18
the spores of Agaricus compestris and other basidiomycetous fungi, *bulletin*	16	1–43
wild rice seed	90	7, 11–12
tests of buried seeds	83	11–19
Gluten in wheat, improvement in quality	78	91–95
Goat raising in south Alaska	82	21
Goats in Algeria	80	90
Arizona	67	34
prickly pear for feeding	74	30
Golden seal, *paper*	51	35–46
collection and preparation of root	51	39
cultivation	51	40–44
description of plant	51	37–38
rhizome, or rootstock	51	38–39
diminution of supply	51	39–40
habitat and range	51	36
history	51	35–36
market conditions	51	45–46
names, common	51	36
Grafting fig, loquat, mango, and tea	46	8–23
Grafts, apple, manner of wrapping	100	15
results of wrapping	100	16–18
Grain, grade standards	41	13–14
uniformity	41	14–15
grading	41	10–13
hay	31	22
inspection	41	10
moisture determinations, description of apparatus	99	13–21
oil required	99	12–13
preparation of samples	99	10–12
results made with water oven, comparison	99	21–23
quick method of determining moisture, *bulletin*	99	1–24
Grains, small, in Nebraska	59	48
Gram, or chick-pea, in central Texas	13	61–62
Grama, blue, in Nebraska	59	39
grasses in central Texas	13	43–45
side oats, in Nebraska	59	36–37
Grape, composition	24	10
juice, analysis	24	19
fermentation, causes	24	10
prevention	24	10–11
manufacture, California	24	11–14
Eastern States	24	14–16
home	24	16–17
prices and statistics	24	19
recipes	24	18–19
unfermented, historical notes	24	9–10
uses	24	17–19
lime and magnesia requirement	1	28–30
must, manufacture and preservation, *bulletin*	24	1–19
Red Hanepoot variety	25	14
varieties, seedlings, Cape of Good Hope	25	14–16
Vitis rupestris Le Roux	25	16
metallica	25	15
Grapes in Algeria	80	60–64
Grass, alpine meadow, description	84	29–30
growing and handling	84	14
annual meadow, description	84	29
blue, Kentucky, seed, *bulletin*	19	1–19
brome, awnless	31	22–23
in Nebraska	59	23–25
smooth, in central Texas	13	50
western, in Nebraska	59	40

	Bulletin.	Page.
Grass, Colorado, in central Texas	13	39–40
fowl meadow, description	84	27–28
growing and handling	84	13–14
Johnson, extermination experiments, *paper*	72	15–22
implements used	72	20–22
methods of treatment	72	16–20
hay production	72	22
investigations, *bulletin*	11	1–24
poisonous action, *paper*	90	31–34
June (Kentucky bluegrass), characters	84	23, 25, 27
description	84	22–23
growing and handling	84	12–13
lands of the south Alaska coast, *bulletin*	82	1–38
nerved manna, description	84	31
orchard, *paper*	100	45–56
reed meadow, description	84	31
rescue, seeds	25	5–8
Rhodes	25	17
rough-stalked meadow, characters, distinguishing	84	25, 27
description	84	24–25
growing and handling	84	13
seeds, rescue grass and chess, *paper*	25	5–8
tall manna, description	84	31
water meadow, description	84	31
wood meadow, characters, distinguishing	84	27–28
description	84	26–27
growing and handling	84	13
See also Bluegrass, etc.		
Grasses, Agrostis, North American species, *bulletin*	68	1–68
and forage crops of western Oregon and Washington	94	14–38
Northwestern States, *bulletin*	31	1–28
plants, Alaska, *bulletin*	82	1–35
Arizona, *bulletin*	4	1–31
	67	1–62
California, northwestern, *bulletin*	12	1–81
classification	59	18–23
by duration of life	59	18–19
methods of utilizing	59	20–23
natural groups	59	19–20
cooperative experiments, *bulletin*	10	1–23
indexes	9	16
	12	79–81
	15	59–60
	38	47–51
	59	57–61
	68	61–64
	75	25–26
Johnson grass, extermination, *paper*	72	15–22
investigations	11	1–24
poisonous action, *paper*	90	31–34
Leptochloa, North American species, *bulletin*	33	1–24
native in Alaska	82	16–19
Nebraska, *bulletin*	59	1–64
Nevada and Oregon, *bulletin*	15	1–60
prickly pear and other cacti, *bulletin*	74	1–46
purchase and collection of seeds, roots, and specimens	10	7
seed bed	59	45
distribution	10	11–17
Texas, central, *bulletin*	13	1–72
Washington, Oregon, California, and Nevada, *bulletin*	38	1–52

	Bulletin.	Page.
Grasses and forage plants, Washington State	75	11–26
blue, seeds, *bulletin*	84	1–38
Kentucky bluegrass seeds, *bulletin*	19	1–19
miscellaneous, central Texas	13	53–54
mixtures with orchard grass	100	47–48
North American species of Agrostis, *bulletin*	68	1–68
Leptochloa, *bulletin*	33	1–24
Spartina, *bulletin*	9	1–16
Great Basin, description	31	12
northern border, description of region	15	12–15
forage conditions, *bulletin*	15	1–60
plants	15	42–55
precipitation	15	13–15
soils	15	15–20
Britain, potato varieties	87	29–30
Plains, description	31	10–11
GRIFFITHS, DAVID, bulletin entitled "Forage conditions and problems in eastern Washington, eastern Oregon, northeastern California, and northwestern Nevada"	38	1–52
"Forage conditions on the northern border of the Great Basin, being a report upon investigations made during July and August, 1901, in the region between Winnemucca, Nevada, and Ontario, Oregon"	15	1–60
"Range improvement in Arizona (Cooperative experiments with the Arizona experiment station)"	4	1–31
"Range investigations in Arizona"	67	1–62
"The prickly pear and other cacti as food for stock"	74	1–48
Guatemala, avocados	77	21–23
Castilla (rubber)	49	25–28
experiments with weevil-resisting cotton	88	7–74
Gypsum, use in crop production	1	9–10

H

	Bulletin.	Page.
Hairy-root of the apple tree	90	15–17
Halogen compounds, physiological rôle	45	24–28
HARTER, LEONARD L., bulletin entitled "The variability of wheat varieties in resistance to toxic salts"	79	1–48
HARTLEY, CHARLES PINCKNEY, bulletin entitled "Injurious effects of premature pollination; with general notes on artificial pollination and the setting of fruit without pollination"	22	1–48
Hawaii, avocados	77	26–27, 35
Hawkweed seeds, description	84	34
Hay, baling	31	26–27
caps	94	11
crops in Arizona	67	57–58
Nevada and Oregon	15	33–37
handling	15	35–37
Johnson grass	72	22
making in western Oregon and Washington	94	9–11
methods of curing	94	10–11

	Bulletin.	Page.
Hay, orchard grass	100	49–50
stage of growth for cutting	94	9–10
HEDGCOCK, GEORGE GRANT, paper entitled "The crown-gall and hairy-root diseases of the apple tree"	90	15–17
and VON SCHRENK, HERMANN, paper entitled "The wrapping of apple grafts and its relation to the crown-gall disease"	100	13–20
Hedge plants, fruit bearing	25	16–17
Hemp, Manila, propagation	46	23–26
HENKEL, ALICE, bulletin entitled "Wild medicinal plants of the United States"	89	1–76
paper entitled "Peppermint"	90	19–29
and KLUGH, GEORGE FRED, paper entitled "Golden seal"	51	35–46
Herbs, varieties	21	190–195
Hevea, climate suitable	49	47
comparison with Castilla	49	14
HILLMAN, FREDERICK HEBARD, paper entitled "Descriptions of the seeds of the commercial bluegrasses and their impurities"	84	15–38
"The seeds of rescue grass and chess"	25	5–8
HITCHCOCK, ALBERT SPEAR, bulletin entitled "Cultivated forage crops of the Northwestern States"	31	1–28
"Methods used for controlling and reclaiming sand dunes"	57	1–36
"North American species of Agrostis"	68	1–68
"North American species of Leptochloa"	33	1–24
and LYON, THOMAS LYTTLETON, bulletin entitled "Pasture, meadow, and forage crops in Nebraska"	59	1–64
Hoes, "scuffle"	94	36–37
Hogs in south Alaska	82	21
prickly pear for feeding	74	29–30
Holland, potato varieties	87	30
Homestead laws of Alaska	82	30–35
Horse-radish of Japanese	42	20–22
varieties	21	195
Horses in Algeria	80	88–89
Humidity, atmospheric, in Tunis	92	26–27
Hungary, analyses of soils	1	23
HUNTER, BYRON, bulletin entitled "Farm practice with forage crops in western Oregon and western Washington"	94	1–39
HUSMANN, GEORGE CHARLES [FREDERICK], bulletin entitled "The manufacture and preservation of unfermented grape must"	24	1–19
Hybridity of potatoes, relation to disease resistance	87	25
Hybridization and seed selection, new varieties of tobacco produced	96	64–67

I

	Bulletin.	Page.
Implements used in exterminating Johnson grass	72	20–22
Importations of seeds and plants, Inventory No. 9, *bulletin*	5	1–79
10, *bulletin*	66	1–333
11, *bulletin*	97	1–255
Improving the quality of wheat, *bulletin*	78	1–120
Inbreeding of tobacco necessary	96	22–26
Index,[a] common and scientific names of plants (mainly grasses and forage plants)	9	16
	12	79–81
	15	59–60
	38	47–51
	59	57–61
	68	61–64
	75	25–26
seeds and plants imported	5	75–79
	66	317–333
	97	239–255
general	53	145–155
	58	93–96
	88	79–87
	92	107–110
India, agricultural conditions	35	22–37
fig in Algeria	80	85
grass in Nebraska	59	39
mango scions, importation	46	14–15
rice, consumption as food	35	31–33
farming	35	26–30
		34–37
milling	35	35–36
soils, analyses	1	24
Injurious effects of premature pollination, *bulletin*	22	1–48
"Inland empire," description	31	14–15
Inoculation, legume, *bulletin*	71	1–72
conditions, *paper*	100	73–83
of soil with nitrogen-fixing bacteria, *paper*	72	23–30
with soil bacteria, effect of heavy	100	79–81
See also Bacteria, Legumes, Nitrogen, and Soil inoculation.		
Insect enemies of tobacco	91	34
resisting adaptations of cotton plant	88	7–74
"Internal brown-spot" of potatoes	87	12–13
Introduction, dates, Persian Gulf, *bulletin*	54	1–32
Japanese bamboos, *bulletin*	43	1–36
seeds and plants, *bulletin*	5	1–79
	66	1–333
	97	1–255
Introductions, plant, from Japan, *bulletin*	42	1–24
Inventory of seeds and plants imported, No. 9, *bulletin*	5	1–79
10, *bulletin*	66	1–333
11, *bulletin*	97	1–255
Investigations of rusts, *bulletin*	63	1–32
Iodin compounds, relations of organisms	45	27–28
Iron compounds, physiological rôle	45	21–24
in fungi	45	23
influence on formation of chlorophyll	45	21–22
organic compounds	45	22–23
salts, fertilizing effect	45	22
Irrigation, agriculture in Sahara Desert without irrigation, *bulletin*	86	1–30

---

[a] Bulletins 56 and 89 are also indexes in themselves.

	Bulletin.	Page.
Irrigation, in Algeria	80	29–38
Egypt	62	9–13
the Jerid, Tunis	92	31–33
Italy, analyses of soils	1	22

J

	Bulletin.	Page.
Jamaica yam cultivation	27	12–15
Japan, agricultural conditions	27	33–37
	35	11–21
bamboos, *bulletin*	43	1–36
farm life	35	19–21
wages	35	18
food crops	35	13–14
horse-radish	42	20–22
Lilium longiflorum varieties	39	8–11
lily, Easter, propagation, *bulletin*	39	1–24
manure, practices	35	18
mitsumata, paper plant, *paper*	42	9–17
paper plants, varieties	42	11
plant introductions, *bulletin*	42	1–24
rice culture	35	14–16
cutting	35	17–18
field work	35	16–17
profits in growing	35	18–19
soils, analyses	1	23
three new plant introductions, *bulletin*	42	1–24
udo, a winter salad, *paper*	42	17–20
Japanese bamboos and their introduction into America, *bulletin*	43	1–36
Jerid, drainage system	92	33
geography	92	11–17
irrigation system	92	31–33
soils	92	33–41
water supply	92	28–31
Johnson grass, *bulletin*	11	1–24
control	11	11–13
description	11	7
dissemination	11	9–11
eradication	11	13–19
extermination, *paper*	72	15–22
nutritive value	11	20–22
origin and distribution	11	7–9
poisonous action, *paper*	90	31–34
Texas, central	13	45
utilization	11	19–23
JONES, LEWIS RALPH, bulletin entitled "Disease resistance of potatoes"	87	1–39

K

	Bulletin.	Page.
Kadiak Island, Alaska, description of grass lands	82	11–12
Kafir plum as a shade tree	25	18
Kainit, action on crops	1	12
Kale, thousand-headed, in western Oregon and Washington	94	33-35
methods of feeding	94	34–35
sowing	94	34
seed crop	94	35
varieties	21	195–200
KEARNEY, THOMAS HENRY, bulletin entitled "Agriculture without irrigation in the Sahara Desert"	86	1–30
"Date varieties and date culture in Tunis"	92	1–112

	Bulletin.	Page.
KEARNEY, THOMAS HENRY, and MEANS, THOMAS HERBERT, bulletin entitled "Agricultural explorations in Algeria"	80	1-98
Kelep protection of cotton plants	88	34-37
KELLERMAN, KARL FREDERIC, and BECKWITH, THEODORE DAY, paper entitled "The effect of copper upon water bacteria"	100	57-71
MOORE, GEORGE THOMAS, bulletin entitled "A method of destroying or preventing the growth of algæ and certain pathogenic bacteria in water supplies"	64	1-44
"Copper as an algicide and disinfectant in water supplies"	76	1-55
ROBINSON, THOMAS RALPH, paper entitled "Conditions affecting legume inoculation"	100	73-83
Kenai peninsula, Alaska, description	82	13-14
Kentucky bluegrass seed: Harvesting, curing, and cleaning, *bulletin*	19	1-19
Key, descriptive, to characters of dates	92	94-106
to varieties of lettuce	69	24-27
KLUGH, GEORGE FRED, and HENKEL, ALICE, paper entitled "Golden seal"	51	35-40
KNAPP, SEAMAN ASAHEL, bulletin entitled "Recent foreign explorations, as bearing on the agricultural development of the Southern States"	35	1-44
paper entitled "The work of the community demonstration farm at Terrell, Tex."	51	9-14
Knot-grass in central Texas	13	46
Kohl-rabi, varieties	21	200-202
Kraemer, Dr. Henry, statements regarding the toxic influence of copper	76	49-50
experiments with copper foil in water supplies	76	41-43

L

Lamb's-quarters, seeds, description	84	35
Land laws of Alaska	82	29-35
Late-blight and rot of potatoes	87	19-22
Latex, or milk, of rubber trees	49	32-39 40-43
coagulation	49	69-73
extraction	49	62-66
Laws regarding agricultural lands in Alaska	82	29-35
Leaf and blood, relation between coloring matter	45	21
spot, apple, effect of Bordeaux mixture	93	21
potato	87	13-16
Lecithin, physiological importance	45	17-18
Leek, varieties	21	203-205
Legal and customary weights per bushel of seeds, *paper*	51	27-34
Legume inoculation, conditions, *paper*	100	73-83
effect of lime	100	74-76
soil conditions	100	76-79
Legumes, Arizona	4	18-19
bacteria for soil inoculation, *bulletin*	71	1-72

	Bulletin.	Page.
Legumes, bacteria for soil inoculation, *paper*	72	23–30
	100	73–83
conditions affecting inoculation, *paper*	100	73–83
cross-inoculation and characters of bacteria	71	25–27
effect of nodules	71	15–18
varying conditions upon bacteria	71	28–31
fixation of nitrogen without forming nodules	71	36–37
inoculation by pure cultures	71	37–38
	72	29–30
of soil with nitrogen-fixing bacteria, *paper*	72	23–30
methods of cultivating bacteria	71	27–28
	72	26
using liquid cultures	71	38–39
	72	26–27
nature	94	13–14
nitrogen-gathering organism, nature	71	22–25
nodule-bearing, effect upon succeeding crops	71	12–15
		18–19
nodules not always beneficial	71	34–35
soil inoculation, *bulletin*	71	1–72
paper	72	23–30
results and reports	71	43–71
Texas, central	13	54–65
time of inoculating with bacteria	71	39–40
See also Bacteria, Nitrogen, and Soil inoculation.		
Leguminous crops, effect upon succeeding crops	71	12–15
		18–19
plants, nature and relation to bacteria	94	13–14
Lemon, coloring bed	52	15
house	52	14–15
leaf-spot and wither-tip	52	12
spot	52	13
treatment	52	17–18
Lentils in Egypt	62	60
Leptochloa, North American species, *bulletin*	33	1–24
Lepto-uridineæ, experiments	63	25–27
Letters on agriculture in the West Indies, Spain, and the Orient, *bulletin*	27	1–40
Lettuce, American varieties, *bulletin*	69	1–103
catalogue of variety names	69	80–103
classes	69	12–13
color	69	18
cultural peculiarities	69	11–12
environment and selection	69	10–11
habit	69	15–16
leaves	69	16–18
maturity	69	14
nomenclature	69	9–10
seedling plants	69	19
seeds	69	18–19
shooting to seed	69	14–15
size	69	13–14
source of seed	69	11
terms used in description	69	12–19
varieties	21	205–226
classed as distinct, description	69	28–80
classification	69	23–24
description	69	9–11
key	69	24–27
suited to different conditions	69	19–20
table	69	21–23
Lilium longiflorum, deterioration, cultivation, and varieties	39	8–16
reproduction from seed	39	16–21
Lily, Bermuda, industry	39	7–8
calla, soft rot, *bulletin*	60	1–47

	Bulletin.	Page
Lily, calla, soft rot, cause	60	12–13
comparison with similar organisms	60	38–40
effect	60	15
general appearance	60	13–14
morphological characters	60	15–16
origin and spread	60	40–41
physiological characters	60	16–38
remedies	60	42–43
Easter, or Bermuda, Bermuda-grown, deterioration	39	9–11
cultivation in United States	39	11–13
diseases	39	11–15
emasculating and pollinating	39	18–19
investigations in propagating	39	13–15
Japan-grown, deterioration	39	9–11
planting in open ground	39	15–16
propagation from seed, *bulletin*	39	1–24
reproduction from seed	39	16–17
seedlings, pricking off	39	20–21
seeds, sowing	39	19–20
varieties from Japan	39	8–11
Lime and magnesia as carbonates in sand cultures	1	43–45
soil cultures	1	46–47
nitrates and sulphates in water cultures	1	39–43
in sand cultures	1	47–50
experiments with barley	1	44–45
cowpeas	1	39–42 49, 51–52
oats and cowpeas	1	46–47
wheat, and beans	1	45
privet	1	42–43
tobacco	1	43, 44 49–50
wheat and oats	1	48–49
extracted by various plants	1	33
functions, theoretical, discussion	1	16
in animals, proportion	45	65–67
chestnut tree	1	30
countries, various	1	18
plants, various	1	30–33
river deposits, ratio	1	26
soils, correction	1	33–35
sugar beet	1	30–33
tobacco leaf ash	1	27
soils	1	27–28
relation to plant growth, *bulletin*	1	1–53
requirements of grape	1	28–30
as sulphate in soil cultures	1	50–52
effect upon inoculation of legumes	100	74–76
incrustations	45	46
in earth's crust	1	13
plants, distribution	45	35–37
rôle, in the soil	1	37
salts, functions	45	41–46
importance for animals	45	64–65
life without	45	52–54
physiological importance	45	38–39
rôle	45	35–70
transportation of starch	45	54–55
Limes, anthracnose	52	11–12
fruit canker	52	12
treatment of trees	52	18
wither-tip	52	12
Liming of soils from a physiological standpoint, *paper*	1	9–35
List of American varieties of peppers, *bulletin*	6	1–19

	Bulletin.	Page.
List of American varieties of vegetables, *bulletin*	21	1-402
See also Apple, Cotton, Date, Fungi, Grasses and forage plants, Lettuce, Medicinal plants, Seeds and plants imported, Soy beans, and Tobacco for lists of varieties; *also* Names.		
Live stock, Arizona, carrying capacity of ranges	67	32-34
injurious plants	67	59-60
water supply	67	34-38
handling, Nevada and Oregon	15	20-23
in Algeria	80	87-90
prickly pear for feeding, *bulletin*	74	1-46
Loco weed, Arizona	67	59
Loew, Oscar, bulletin entitled "The physiological rôle of mineral nutrients in plants"	45	1-70
paper entitled "Liming of soils from a physiological standpoint"	1	9-35
Loquat, propagation	46	15-17
Louisiana, analyses of soils	1	18
Lupine, Alaska	82	17-18
experiments with lime	1	17
Lupines in Egypt	62	61
Lyon, Thomas Lyttleton, bulletin entitled "Improving the quality of wheat"	78	1-120
and Hitchcock, Albert Spear, bulletin entitled "Pasture, meadow, and forage crops in Nebraska"	59	1-64

M

	Bulletin.	Page.
Macaroni and semolina, manufacture, *bulletin*	20	1-31
comparison of foreign and domestic	3	41-43
cooking and serving, methods	70	20-21
recipes	70	21-31
demand	20	10-11
exportation, possibility	70	20
good, characteristics	70	13-14
industry, development in France	20	10-11
manufacture	20	13-14, 24-29
manufacturers in United States, list	70	16-20
process of manufacture	70	14-15
use of durum wheat	70	13-31
macaroni wheat	3	29-44
wheat, saragolla	25	9-12
wheats, *bulletin*	3	1-62
See also Wheat, durum.		
McKenney, Randolph Evans Bender, paper entitled "The wilt disease of tobacco and its control"	51	5-8
Madarake or Ummon-chiku bamboo	43	28
Magnesia and lime in animals, proportion	45	65-67
relation to plant growth, *bulletin*	1	1-53
in plants, distribution	45	35-37
seeds	45	58-59
rôle, in the soil	1	37-38
Magnesium chlorid, resistance of wheat varieties	79	25-26 34-36
salts, injurious action	1	10
necessity for fungi	45	59-60
physiological rôle	45	35-70
poisonous action	45	49-52
replaced by beryllium salts	45	60-63
sulphate, resistance of wheat varieties	79	23-25 34-36

	Bulletin.	Page.
Maize. *See* Corn.		
Manganese in plants	45	23–24
Mangel-wurzels in western Oregon and Washington	94	35–37
Mango, budding	46	9–13
culture	28	13–21
requirements	28	13–14
description	28	10–11
diseases	28	20–21
in Porto Rico, *bulletin*	28	1–38
introduction of new varieties	28	32–33
market	28	35–36
origin	28	11–13
packing and shipping	28	33–35
Porto Rican forms	28	27–28
propagation, methods	28	14–19
	46	8–15
seedling stocks	46	13–14
uses	28	21–25
varieties to be introduced	28	28–32
Manila hemp, propagation	46	23–26
Manufacture and preservation of unfermented grape must, *bulletin*	24	1–19
of semolina and macaroni, *bulletin*	20	1–31
Manure for mushroom growing	85	23–31
		33–36
Martynia, varieties	21	226
Massachusetts, Cape Cod sand dunes, reclamation, *bulletin*	65	1–38
MAY, DAVID WILLIAM, paper entitled "Experimental study of the relation of lime and magnesia to plant growth"	1	37–53
Mayweed seeds, description	84	35
Meadows, orchard grass	100	49
MEANS, THOMAS HERBERT, and KEARNEY, THOMAS HENRY, bulletin entitled "Agricultural Explorations in Algeria "	80	1–98
Medicinal plants, wild, of the United States, *bulletin*	89	1–76
Melon, muskmelon, varieties	21	226–241
watermelon, varieties	21	391–402
Menthol and peppermint oil	90	26–27
MERRILL, ELMER DREW, bulletin entitled "The North American species of Spartina"	9	1–16
Mesquite, curly, in central Texas	13	41–42
Method of destroying or preventing the growth of algæ and certain pathogenic bacteria in water supplies, *bulletin*	64	1–44
quick, for determining moisture in grain, *bulletin*	99	1–24
Methods of testing the burning quality of cigar tobacco, *paper*	100	31–40
used for controlling and reclaiming sand dunes, *bulletin*	57	1–36
Mexico, avocados	77	24–25
southern, Castilla	49	25–28
Microspira comma, effect of copper	64	34–36, 39
	76	46
Microspores in Zamia, development	2	16–19
Millet, Japanese barnyard, in Nebraska	59	41
Millets in central Texas	13	46–47
Egypt	62	59–60
Nebraska	59	46–47
Mineral compounds in organisms	45	12–13
constituents in organisms	45	9–16
nutrients in plants, *bulletin*	45	1–70
low atomic weight	45	15–16
salts, value	45	14–15
substances, functions	45	13
Minnesota, analyses of soils	1	20
experiments with hairless Orel red clover	95	31–35
MISCELLANEOUS PAPERS, *bulletin*	25	1–82

	Bulletin.	Page.
MISCELLANEOUS PAPERS, *bulletin*	51 72 90 100	1–46 1–30 1–34 1–83
Mitsumata, a Japanese paper plant	42	9–17
leather paper manufacture	42	15–17
paper manufacture	42	14–15
plant	42	11–14
cultivation	42	12–14
Moisture determinations of grain, percentage basis	99	8–9
preparation of samples	99	10–12
quality and quantity of oil required	99	12–13
quick method, *bulletin*	99	1–24
MOORE, GEORGE THOMAS, bulletin entitled “Soil inoculation for legumes; with reports upon the successful use of artificial cultures by practical farmers”	71	1–72
and KELLERMAN, KARL FREDERIC, bulletin entitled—		
“A method of destroying or preventing the growth of algæ and certain pathogenic bacteria in water supplies”	64	1–44
“Copper as an algicide and disinfectant in water supplies”	76	1–55
Mosaic disease of tobacco, *bulletin*	18	1–24
M’raïer, Algeria, alkali conditions	53	88–89
Mulberry, planting	34	16–17
propagation by cuttings	34	9–11
grafting and budding	34	13–16
seeds	34	11–13
pruning	34	17–18
soil	34	16
Mules in Algeria	80	89
Mushroom growing, acidity and alkalinity affecting growth	85	30–31
and spawn making, *bulletin*	85	1–60
beds, installation	85	37
spawning and casing	85	38–39
caves in the United States	85	48–49
compost used and its preparation	85	33–36
cooperative experiments	85	47–48
culture in open air	85	49–51
experiments at Columbia, Mo	85	39–48
general conditions and history	85	10–11
germination studies	85	12–18
earlier work	85	12–14
experiments	85	14–18
market conditions	85	11–12
nutrition experiments	85	23–31
results of growth on various media	85	23–31
species cultivated in experiments	85	19–23 46–47
temperature and moisture	85	31–33
tissue cultures	85	18–23
variability of product	85	45–46
yield of experimental beds	85	39–45
spawn making	85	52–58
a “chance” method	85	52–53
commercial process	85	55–58
pure-culture method	85	53-54
a “selective” method	85	53
tissue-culture method	85	54–55
vitality	85	58–60

	Bulletin.	Page.
Mushrooms, germination of the spores of Agaricus campestris and other basidiomycetous fungi, *bulletin*	16	1-43
Must, grape, manufacture and preservation, *bulletin*	24	1-19
Mustard, varieties	21	241-244

N

	Bulletin.	Page.
Names, common and scientific, of grasses and forage plants, index	12	79-81
	15	59-60
	38	47-51
	59	57-61
	75	25-26
seeds and plants imported, index	5	75-79
	66	317-333
	97	239-255
scientific, of grasses and forage plants, index	9	16
	68	61-64
varieties of apples, list	56	21-374
		387-395
cotton, list	25	47-53
dates in Tunis, list	92	55-94
Oued Souf, list	86	25-26
on Persian Gulf, list	54	21-27
fungi, list	8	8-31
lettuce, list	69	80-103
medicinal plants, wild, list	89	7-76
peppers, list	6	13-19
soy beans	98	12-26
tobacco, list	91	11-15
vegetables, list	21	15-402
Natal pineapple	25	20-22
Nebraska, annual forage crops	59	45-50
climatic and soil conditions	59	13-16
crops	59	16-18
experiments with hairless Orel red clover	95	22-27
grasses, native	59	42-43
pasture, meadow, and forage crops, *bulletin*	59	1-64
pastures and meadows	59	42-45
tame	59	44
physiography	59	15
rainfall	59	13-14
soil	59	16
temperature	59	14-15
Needle grass in central Texas	13	47-48
Nefzaoua, geography	92	17-19
Nematodes, cowpea disease	17	23-36
plants affected	17	24-25
resistant plants and stocks	17	29-36
treatment	17	27-29
Netherlands, sand fixation	57	22-25
Nevada, date palm suitable	53	125-126
northern, forage conditions, *bulletin*	15	1-60
northwestern, forage conditions, *bulletin*	38	1-52
New Mexico, date palm suitable	53	133-134
Nile Valley forage and soiling crop, berseem, *bulletin*	23	1-20
Nitragin, cultures of nitrogen-gathering bacteria	71	21-22
Nitrogen content of wheat, conditions affecting	78	40-46
relation of size of kernel	78	35-37
specific gravity	78	39-40
yield affected by length of growing period	78	104-111
to the acre	78	72-76
fixation by legumes, *bulletin*	71	1-72

	Bulletin.	Page.
Nitrogen fixation by legumes, *paper*	72	23–30
	100	73–83
how and where supplied to legumes	71	31–34
how fixed by legumes	71	9–12
infection by legumes without forming nodules	71	36–37
See also Bacteria, Legumes, and Soil inoculation.		
Nodule formation, effect of lime	100	74–76
soil conditions	100	76–79
See also Bacteria, Legumes, and Nitrogen.		
Nomenclature, apple, *bulletin*	56	1–395
fungi, *bulletin*	8	1–31
lettuce, *bulletin*	69	1–103
medicinal plants, wild, *bulletin*	89	1–76
peppers, *bulletin*	6	1–19
soy beans, *bulletin*	98	1–30
vegetables, *bulletin*	21	1–402
See also Names.		
North American species of Agrostis, *bulletin*	68	1–68
Leptochloa, *bulletin*	33	1–24
Spartina, *bulletin*	9	1–16
Dakota, analyses of soils	1	20
experiments with hairless Orel clover	95	35–39
Northwestern States, cultivated forage crops, *bulletin*	31	1–28
description of regions	31	9–15
Notes on Egyptian agriculture, *bulletin*	62	1–61
Novelties and specialties, seeds, distribution circulars	25	26–46
Nursery trees frozen	51	18
Nurserymen, suggestions regarding apple grafts	100	19
seedling apple trees	90	16–17
Nutrients, mineral, in plants, *bulletin*	45	1–70
Nuts, Spanish almonds, *bulletin*	26	1–16

O

Oakley, Russell Arthur, paper entitled "Orchard grass"	100	45–56
Oat-grass, tall, in Nebraska	59	39
Oats and wheat in central Texas	13	65–66
in Algeria	80	76
sown with red clover	94	15
Observations on the mosaic disease of tobacco and its control, *bulletin*	18	1–24
Oil of peppermint	90	26–29
quality and quantity required for moisture determinations of grain	99	12–13
Okra, varieties	21	244–246
Oliver, George Watson, bulletin entitled "Budding the pecan"	30	1–20
"Silkworm food plants: Cultivation and propagation"	34	1–20
"The propagation of the Easter lily from seed"	39	1–24
"The propagation of tropical fruit trees and other plants"	46	1–28
Olives in Algeria	80	64–66
Onion, varieties	21	246–263
Onions in Egypt	62	58–59
Orach, varieties	21	264
Orange and pomelo, leaf-spot	52	15
wither-tip	52	16
See also Citrus fruits.		
leaf-rust of Agropyron and Elymus	63	17
Orchard grass, *paper*	100	45–56

	Bulletin.	Page.
Orchard grass, hay	100	49–50
in Nebraska	59	32–33
Northwestern States	31	24
Oregon and Washington, western	94	27
meadows, life	100	49
mixtures with red clover, etc	100	47–48
pasture	100	50
seed	100	50–54
handling the aftergrowth	100	52
harvesting	100	51
other grasses in seed fields	100	54
thrashing	100	51–52
value of straw	100	52–53
weeds in seed fields	100	53–54
seeding	100	46–47
uses and value	100	49–54
Orchards, apple, results of spraying for bitter-rot	93	28–30
Oregon, eastern, forage conditions, *bulletin*	38	1–52
southern, forage conditions, *bulletin*	15	1–60
western, forage crops, *bulletin*	94	1–39
rainfall, etc	94	8–9
Orel, Russia, soil and climate	95	19–21
source of hairless red clover	95	19
Orton, William Allen, paper entitled "The wilt disease of the cowpea and its control"	17	9–22
and Webber, Herbert John, paper entitled "A cowpea resistant to root-knot (Heterodera radicicola)"	17	23–38
Oued Souf, Africa, agriculture without irrigation, *bulletin*	86	1–30
climate	86	13–15
date gardens	86	18–26
care of palms	86	21
harvest	86	24–25
manuring	86	22–24
planting	86	19–21
sand encroachments	86	22
varieties	86	25–26
yield	86	25
description of region	86	9–11
population	86	12
soils	86	18
temperatures	86	13–14
water supply	86	16–17
Ourlana, Algeria, alkali conditions	53	89–96
Oxen, prickly pear for feeding	74	30–33

P

Pacific coast, upper, region, description	31	13
Palm, date, and its utilization in the Southwestern States, *bulletin*	23	1–155
age of bearing	53	25–26
alkali resistance	53	72–121
care necessary in growing	53	25–30
cold-air drainage	53	61–62
resistance	53	59–61
distance between trees	53	22–23
drainage	53	50–52
historical description	53	13–17
in Tunis, culture	92	41–55
harvesting	92	52–54
irrigating	92	47–48
labor and tenantry system	92	42–43
male palms and pollinating	92	50–51
manuring	92	49–50
methods of culture	92	52

	Bulletin.	Page.
Palm, date, in Tunis, planting	92	46–47
preparing the land	92	45
preserving the fruit	92	54–55
propagation	92	51–52
ripening of fruit	92	51–52
size and value of gardens	92	41–42
varieties	92	55–106
irrigation	53	44–50
male trees required	53	23
varieties	53	24–25
offshoots	53	20–22
on Persian Gulf, diseases and pests	54	27–28
irrigation	54	14–19
location of gardens	54	11–13
planting young trees	54	19–20
pollination	54	20
soils	54	13–14
treatment	54	19–20
subsidiary cultures	54	19
varieties	54	21–28
Bagdad sorts	54	22–24
Bassorah sorts	54	24–25
Bunder Abbas sorts	54	25
Guadur sorts	54	27
Hassa sorts	54	25
Jask sorts	54	25
Maskat sorts	54	25–27
pollination	53	26–29
propagation	53	18–25
rain, effects	53	52–58
resistance to cold	53	59–61
seedlings	53	18–20
shelter for fruit trees	53	43–44
subsidiary cultures	53	115
sunshine necessary	53	58
water necessary	53	44–49
wind, effects	53	70–72
dwarf, in Algeria	80	98
See also Date.		
Panicularia, descriptions of species	84	31
Paper plant, Japanese, mitsumata	42	9–17
Parsley, varieties	21	264–268
Parsnip, varieties	21	268–272
Pasture, meadow, and forage crops in Nebraska, *bulletin*	59	1–64
Pastures, orchard grass	100	50
Washington State, alternation	75	23–24
mountain areas	75	17–20
protection	75	20–23
semiarid lands	75	15–17
use too early in spring	75	24
winter grazing	75	13–15
PATTERSON, FLORA WAMBAUGH, bulletin entitled "A collection of economic and other fungi prepared for distribution"	8	1–31
Pea. *See* Peas.		
Peach, cold storage, *bulletin*	40	1–28
orchards frozen, treatment	51	15–17
Peanuts in central Texas	13	66–67
Egypt	62	60–61
results of inoculation	71	70
varieties	21	293
Pear, cold storage, *bulletin*	40	1–28
keeping quality, influence of delayed storage	40	14–15
different temperatures	40	15–16
maturity	40	13–14
type of package	40	16–18
wrapper	40	18–19

	Bulletin.	Page.
Pear, prickly, and other cacti as food for stock, *bulletin*	71	1–18
burners	74	19–20
chopping	74	14
cost of feeding	74	41–43
methods of feeding to stock	74	12–16
handling	74	15–16
plantations	74	38
postulates of feeding cacti	74	43–46
removal of edge of joints	74	14–15
singeing the spines over a fire	74	12
with a torch	74	13
species of value for forage	74	37–38
steaming	74	13–14
thickets, destruction	74	36–37
time required for new crop	74	40
torches for burning cacti	74	19–20
use as stock food, history	74	10–11
yield as forage	74	39
trees, frozen, treatment	51	18–19
Peas and beans in central Texas	13	60–64
Canada field, in Nebraska	59	50
field	31	25
	94	22–23
in central Texas	13	61
results of inoculation	71	70
garden, effect of inoculation	100	79–80
results of inoculation	71	62–65
varieties	21	272–293
sweet, results of inoculation	71	69
Pecan, budded trees, transplanting	30	16–18
budding, *bulletin*	30	1–20
difficulties	30	9
importance	30	10
methods	30	13–15
buds, location	30	12–13
of current season, experiments	30	13
selection	30	11–12
starting into growth	30	15
seedling stocks	30	10–11
Pepper. *See* Peppers.		
Peppergrass seeds, description	84	32
Peppermint, *paper*	90	19–29
conditions injurious to crop	90	23–24
countries where grown	90	20–21
cultivation in United States	90	21–22
methods	90	22–24
description	90	19–20
distillation of oil	90	24–26
harvesting	90	24–25
oil and menthol	90	26–27
exports	90	27–28
prices	90	28–29
still, description	90	25–26
Peppers, American varieties, *bulletin*	6	1–19
list	21	294–300
Perfumery plants in Algeria	80	86–87
Persian Gulf dates, *bulletin*	54	1–32
region, agricultural conditions	27	27–30
climate	54	9–11
description	54	8–9
soil conditions	54	13–14
Philippine Islands, agricultural conditions	35	40–44
cultivation of Manila hemp	46	23–26
milch cattle and carabaos for	27	31–33
opportunities for agricultural and botanical research	27	15–19

	Bulletin.	Page.
Philippine Islands, rubber culture	49	17–18
Phosphoric acid in chlorophyll	45	19
physiological rôle	45	16–20
relation to proteids and to division of cells	45	16–17
Phycomyces nitens, formation of spores, ***bulletin***	37	1–40
Phyllostachys aurea	43	30
bambusoides	43	30–31
castillonis	43	29–30
henonis	43	28
marliacea	43	31
mitis	43	27
nigra	43	29
quilioi	43	27–28
See also Bamboos and Bambusa.		
Physiological rôle of mineral nutrients in plants, ***bulletin***	45	1–70
Pieters, Adrian John, and Brown, Edgar, bulletin entitled "Kentucky bluegrass seed: Harvesting, curing, and cleaning"	19	1–19
Pigweed seeds, description	84	35
Pine, western yellow, "blue" wood	36	11–15
decay	36	26–31
growth of blue color	36	11–12
lasting power	36	14–15
nature	36	12–13
strength	36	13–14
"bluing" and "red-rot," *bulletin*	36	1–40
death of trees	36	9–11
diseased wood, disposal	36	32–33
quantity	36	31–32
value	36	33
inspection of timber	36	33–34
"red-rot"	36	26–31
cause	36	27–28
conditions favoring	36	28
final stages and fruiting organs	36	28–30
rate of growth	36	30–31
See also Timber and Wood.		
Pineapple, Natal	25	20–22
Pinkroot, chief substitutes	100	42–43
drug so known, *paper*	100	41–44
methods of distinguishing	100	43–44
minor adulterants	100	43
trade varieties	100	41–42
Piper, Charles Vancouver, bulletin entitled "Grass lands of the south Alaska coast"	82	1–38
Pistillate cones in Zamia, development	2	19–22
Plant breeding, potatoes	87	20–39
tobacco, *bulletin*	96	1–71
growth, relation of lime and magnesia, *paper*	1	37–53
introductions from Japan, *bulletin*	42	1–24
Plantain, English, description of seeds	84	35
Plantains in Arizona	4	15–17
Plants and seeds imported, Inventory No. 9, ***bulletin***	5	1–79
10, *bulletin*	66	1–333
11, *bulletin*	97	1–255
drug, wild, *bulletin*	89	1–76
marine, percentage of lime and magnesia content	1	14
mineral nutrients, *bulletin*	45	1–70
of Arizona	4	9–31
	67	9–62
propagation, *bulletin*	46	1–28
Plum, Kafir, as a shade tree	25	18
trees, frozen, treatment	51	17–18
Poa, or bluegrasses, comparison of characters	84	20–22
descriptions of species	84	15–38

	Bulletin.	Page.
Poa, or bluegrasses, key to commercial seeds	84	19
seeds of common species in herbaria	84	18
sudetica, description	84	30–31
growing and handling	84	14
See also Bluegrass and Bluegrasses.		
Poisonous action of Johnson grass, *paper*	90	31–34
plants, California, northwestern	12	73–74
Nevada and Oregon	15	41–42
Pollen tube in Zamia, development	2	22–39
Pollination, artificial, *bulletin*	22	1–48
experiments with blossoms of cotton	22	19–22
Datura tatula	22	19
orange	22	23–25
tobacco	22	10–18
tomato	22	26–35
premature, injurious effects, with general notes on artificial pollination and the setting of fruit without pollination, *bulletin*	22	1–48
Polyporus fraxinophilus, disease of white ash, *bulletin*	32	1–20
distribution	32	10
method of attack	32	11
remedies	32	18
sporophores	32	12–14
Porto Rico, avocados	77	23–24 34–35
Castilla (rubber) culture	49	17
mango, *bulletin*	28	1–38
Potassium bromid, effect on plants	45	27
chlorid, value for buckwheat	45	24–25
phosphate as a cell constituent	45	19–20
salts, formation of starch and protein	45	28–30
physiological superiority	45	34–35
replaced by rubidium salts	45	31–32
Potato culture in Europe	87	9–12
diseases, blackleg	87	17–18
filosité, or growing-out	87	13
internal brown-spot	87	12–13
late-blight and rot	87	19–28
leaf-spot	87	13–14
scab and scablike diseases	87	14–17
resistance	87	35–36
sweet, in central Texas	13	69
Potatoes, best varieties in United States and Canada	87	33–35
disease resistance, *bulletin*	87	1–39
resistant varieties, America	87	28–31
Europe	87	31–36
dry-rot due to Fusarium oxysporum, *bulletin*	55	1–62
effect of disease	55	13–19
fertilizers on resistance	55	19–27
literature	55	61–62
remedial measures	55	52–54
POWELL, GEORGE HAROLD, and FULTON, SANFORD HAMILTON, bulletin entitled—		
"Cold storage, with special reference to the pear and peach"	40	1–28
"The apple in cold storage"	48	1–66
Prairie dogs	67	46
Precipitation. *See* Rainfall.		
Preliminary study of the germination of the spores of Agaricus campestris and other basidiomycetous fungi, *bulletin*	16	1–43
Prickly pear and other cacti as food for stock, *bulletin*	74	1–48
cutters	74	17–19
effect of food upon stock	74	33–35
ensilage	74	35–36

	Bulletin.	Page.
Prickly pear, food for cattle	74	24-29
cows, dairy rations	74	22-24
milk production	74	20-24
hogs	74	29-30
oxen	74	30-33
sheep and goats	74	30
machines for cutting cacti	74	16-20
Principles of mushroom growing and mushroom spawn making, *bulletin*	85	1-60
Propagation of the Easter lily from seed, *bulletin*	39	1-24
tropical fruit trees and other plants, *bulletin*	46	1-28
Proteid nitrogen, increase, results of breeding	78	95-100
Proteids in wheat kernel, selection to increase quantity	78	76-91
Prothallus in Zamia, development	2	22-39
Pseudomonas campestris, black-rot bacterium, *bulletin*	29	1-20
Puccinea vexans, rust	63	22-25
Puget Sound, farm practices in territory near, *bulletin*	94	1-39
Pumpkin, varieties	21	300-307
Punjab, British India, agricultural conditions	35	34-35

Q

Quick method for the determination of moisture in grain, *bulletin*	99	1-24

R

Radish, varieties	21	307-332
Ragan, William Henry, bulletin entitled "Nomenclature of the apple; a catalogue of the known varieties referred to in American publications from 1804 to 1904," with additions and corrections	56	1-395
Railroads, ballast, Europe	14	39
cross-ties, Europe	14	32-96
form	14	34-35
impregnation	14	24-96
kinds of timber	14	34
prevention of splitting	14	37
removal and disposal	14	61-62
specifications	14	35-96
stacking	14	37-38
United States	14	27-32
experiments	14	29-32
rail fastenings, Europe	14	40
tie plates, Europe	14	39
See also Pine, Timber, and Wood.		
Rainfall in Alaska	82	27
Algeria	80	22-24
Arizona	4	28-29, 30
	67	41-44
Nebraska	59	13-14
Oregon and Washington, western	94	8-9
Tunis	92	27-28
Rampion, varieties	21	332
Range conditions in Nevada and Oregon	15	23-33
northwestern California, *bulletin*	12	1-81
feed, Arizona	67	46-57
improvement in Arizona, *bulletin*	4	1-31
	67	1-62
central Texas, *bulletin*	13	1-72
investigations in Arizona, *bulletin*	4	1-31
	67	1-62
management in the State of Washington, *bulletin*	75	1-28
Ranges, Arizona, overstocking, etc., *bulletin*	4	1-31
	67	1-62
northwestern California, *bulletin*	12	1-81
carrying capacity	12	34-38

	Bulletin.	Page.
Ranges, Washington, changes in handling	38	14–15
Oregon, California, and Nevada, abuses	38	44–45
conditions and plants	38	15–27
Rape	31	25
in central Texas	13	67
Nebraska	59	50
Oregon and Washington, western	94	30–33
seed crop	94	32–33
sown with red clover	94	16
Recent foreign explorations bearing on agricultural development of Southern States, *bulletin*	35	1–44
Reclamation of Cape Cod sand dunes, *bulletin*	65	1–38
Records of seed distribution and cooperative experiments with grasses and forage plants, *bulletin*	10	1–23
Red clover, new type, *bulletin*	95	1–48
See also Clover, red.		
Red-rot and bluing of western yellow pine, *bulletin*	36	1–40
Redtop	31	22
false (fowl meadow grass), description	84	27–28
growing and handling	84	13–14
in Nebraska	59	36
Refrigeration, mechanical, principles	48	13–15
Relation of lime and magnesia to plant growth, *bulletin*	1	1–53
Rescue grass and chess, seeds, *paper*	25	5–8
in central Texas	13	48–49
Reservoirs, eradication of algæ and pathogenic bacteria, *bulletin*	64	1–44
	76	1–55
Resistance to disease, potatoes, *bulletin*	87	1–39
Resistant cotton plants, *bulletin*	88	1–87
Rhizopus nigricans, formation of spores, *bulletin*	37	1–40
Rhode Island, analyses of soils	1	21
Rhodes grass	25	17
Rhubarb, varieties	21	332–333
Rib-grass seeds, description	84	35
Rice, conditions in United States	35	9–11
in Egypt	62	55–58
wild, artificial propagation	50	21
botanical description	50	13–16
diseases	50	18
distribution and habitat	50	10–12
	90	5–6
fall seeding versus spring seeding	90	7–8
life history and natural propagation	50	13
planting	50	21–22
salt-water limits, *paper*	72	9–14
seed, food value	50	20–21
germination	90	7
effect of temperature	90	12
tests	90	11–12
harvesting	50	18–19
packing for transportation	90	11
preparation for food	50	19–20
storage and germination, *paper*	90	5–14
experiments	90	9–10
methods	50	22–23
	90	8–9
uses and propagation, *bulletin*	50	1–24
varieties	50	16–18
Rittue, Edward Cooper, and Townsend, Charles Orrin, bulletin entitled "The development of single-germ beet seed"	73	1–26
River deposits, analyses	1	26
Robinson, Thomas Ralph, and Kellerman, Karl Frederic, paper entitled "Conditions affecting legume inoculation"	100	73–83

	Bulletin.	Page.
Rocky Mountain region, description	31	11–12
Rolfs, Peter Henry, bulletin entitled "The avocado in Florida; its propagation, cultivation, and marketing"	61	1–36
"Wither-tip and other diseases of citrus trees and fruits caused by Colletotrichum gloeosporioides"	52	1–22
Rooi-bloem, corn parasite	25	18–20
Root crops in western Oregon and Washington	94	35–38
Root-knot of cowpea, description	17	23–24
extent	17	25–27
methods of treatment	17	27–29
plants affected	17	24–25
resistant varieties	17	29–36
Roquette, varieties	21	333
Rubber culture, status	49	13–18
uncertainties	49	14–16
plantations, management	49	76–78
requirements for success	49	80–82
security of investments	49	78–80 83–84
production and climate	49	39–47
tree, Central American, culture, *bulletin*	49	1–86
improvement by selection	49	31–32
latex, or milk	49	32–39 40–43
functions	49	34–35 38–39
structure	49	35–36
Para	49	45–47
See also Castilla.		
Rubidium salts, action on fungi	45	33
in place of potassium salts	45	31–32
Rush, field, description of seeds	84	37
slender, description of seeds	84	37
wood, description of seeds	84	37
Russia, analyses of soils	1	21
Russian red clover, new type, *bulletin*	95	1–48
Rust, Aecidium tuberculatum	63	27–28
crown, of oats	63	13–14
of Agropyron	63	15–17
Agrostis	63	17–18
Chloris	63	18
cocklebur	63	26
cottonwood	63	18–19
Elymus	63	15–17
Euphorbia	63	9–11
Peucedanum foeniculaceum	63	28–29
sunflower	63	11–13
velvet leaf	63	26–27
willow	63	18–19
Puccinea vexans	63	22–25
Rusts, emergency adaptations	63	21–25
investigations, *bulletin*	63	1–32
perennial species	63	27–29
segregation of host plants	63	14–19
winter resistance of uredo	63	19–21
Ruta-bagas in western Oregon and Washington	94	35–37
Rye, beach, in south Alaska	82	16–17
grass, perennial	31	25
wild, in Nebraska	59	40–41
grasses in western Oregon and Washington	94	26–27
wild, in central Texas	13	52–53

S

	Bulletin.	Page.
Sages in Nevada and Oregon	15	42–45
Sahara Desert, date palm, alkali resistance	53	72–99
agriculture without irrigation, *bulletin*	86	1–30
date gardens	86	18–26
Salad, winter, udo	42	17–20
Salsify, varieties	21	333–335
Salt River Valley, Arizona, alkali conditions	53	99–101
water limits of wild rice, *paper*	72	9–14
Saltbushes and their allies in Arizona	4	17–18
in central Texas	13	68
Salton Basin, California, alkali conditions	53	101–114
geography and geology	53	101–104
soil conditions	53	106–114
fertility	53	114
water supply	53	104–106
Salts, toxic, dilute solutions as stimulants of plants	79	42–44
neutralizing effect on other toxic substances	79	39–42
resistance of wheat varieties, *bulletin*	79	1–48
salts used in experiments	79	11
results of experiments as to resistance with different species of plants	79	35–36
Sand binders, *bulletin*	57	1–36
in California, northwestern	12	57–62
Nevada and Oregon	15	37–38
binding, beach grass	65	24–30
brush laying	65	28
forestation	65	30–31
control	65	21–31
dunes, Cape Cod, reclamation, *bulletin*	65	1–38
controlling and reclaiming methods, *bulletin*	57	1–36
in northwestern California	12	56–62
utilization	65	33–34
Sanfoin in central Texas	13	69
Santa Rita Forest Reserve, Arizona, description	67	16–32
Saragolla wheat, *paper*	25	9–12
Scab, apple, effect of Bordeaux mixture	93	26–27
potato	87	14–17
Scald, apple	48	26–33
Scofield, Carl Schurz, bulletin entitled "The Algerian durum wheats: A classified list, with descriptions"	7	1–48
"The commercial grading of corn"	41	1–24
"The description of wheat varieties"	47	1–18
paper entitled "The salt-water limits of wild rice"	72	9–14
and Brown, Edgar, bulletin entitled "Wild rice: Its uses and propagation"	50	1–24
Scolymus, varieties	21	335
Scorzonera, varieties	21	335
Scott, William Moore, bulletin entitled "The control of apple bitter-rot"	93	1–36
Scribner, Frank Lamson-, bulletin entitled "Records of seed distribution and cooperative experiments with grasses and forage plants"	10	1–23
Sea water, soluble salts content	1	13–14
Sedge, oval-headed, description of seeds	84	37–38
Sedges and rushes in Nevada and Oregon	15	46–55
in central Texas	13	49–50
south Alaska	82	17

	Bulletin.	Page.
Sediments of rivers, analyses	1	26
Seed and plant distribution, circulars	25	23–82
introduction, notes from South Africa, *paper*	25	13–22
bed for grasses and clovers	59	45
cotton, distribution in 1903	25	47
distribution records, *bulletin*	10	1–23
Kentucky bluegrass, *bulletin*	19	1–19
orchard grass	100	50–54
plants, tobacco, selection	96	44–54
potatoes, source, relation to disease resistance	87	26–27
propagation of Easter lily, *bulletin*	39	1–24
rape	94	32–33
red clover	94	17
selection, new varieties of tobacco produced	96	62–67
separation, tobacco	96	57–60
sugar beet, development of single germs, *bulletin*	73	1–26
single and multiple germs	73	10–12
distribution	25	68–69
thousand-headed kale	94	35
tobacco, directions for saving	91	34–37
how to secure good quality	91	37–38
methods of saving	96	54–57
plan of distribution	25	70–72
varieties distributed, descriptions and cultural directions, *bulletin*	91	1–40
vetch	94	20–21
Seeds and plants imported during the period from September, 1900, to December, 1903. Inventory No. 10; Nos. 5501–9896, *bulletin*	66	1–333
during the period from December, 1903, to December, 1905. Inventory No. 11; Nos. 9897 to 16796, *bulletin*	97	1–255
through the Section of Seed and Plant Introduction for distribution in cooperation with the agricultural experiment stations. Inventory No. 9; Nos. 4351–5500, *bulletin*	5	1–79
bluegrasses, *bulletin*	84	1–38
adulteration	84	10–11
comparison of characters	84	20–21
description of commercial and hand-gathered seeds	84	9
descriptions of weed seeds commonly found	84	32–38
ergot found in commercial seeds	84	38
germination	84	12
grades and quality of commercial seeds	84	10
growing and handling	84	12–14
key to commercial seeds and herbarium specimens	84	18–19
weight to the bushel	84	11–12
buried, vitality experiments, *bulletin*	83	1–22
cultivated compared with wild species	83	19
effect of depth of burial	83	17–18
germination tests	83	11–17
hard seeds	83	18–19
kinds tested	83	7–9
manner of burial	83	9–11
distribution of novelties and specialties, circulars	25	26–46
germination and vitality, *bulletin*	58	1–96
hard, germination after burial	83	18–19
hardiness, cultivated compared with wild species	83	19

	Bulletin.	Page.
Seeds, legal and customary weights per bushel, *paper*	51	27–34
number produced by tobacco plants	96	21
of rescue grass and chess, *paper*	25	5–8
the bluegrasses, *bulletin*	84	1–38
weeds found in bluegrass seeds, descriptions	84	32–38
respiration	58	74–82
vitality and germination, *bulletin*	58	1–96
apparatus for tests	58	11–13
curing and drying necessary	58	45
effect of climate	58	13–22
moisture and temperature	58	24–44
enzyms	58	82–87
experiments	58	9–90
localities for tests	58	48–50
nature of tests	58	47–48
packages tested	58	65–74
results	58	49–65
varieties tested	58	10–11
literature	58	90–92
losses in different climates	58	22–24
methods of storing and shipping	58	44–65
packing in charcoal and moss	58	47
respiration	58	74–82
storage rooms, importance of dryness	58	46
suggestions of earlier investigators	58	44–45
warehouses, importance of dryness	58	46
Seedsmen, names and abbreviations	6	8–13
	21	10–15
See also American varieties of lettuce.		
Selection, potato improvement	87	25–26
Self-fertility of tobacco	96	18–19
		22–26
Semolina and macaroni, manufacture, *bulletin*	20	1–31
curing	20	27–29
exportation, possibility	70	20
exports, imports, and prices	20	29–31
macaroni wheat demand	3	29–44
mixing	20	26
percentage in various wheats	20	20
preparation	3	43–44
products	20	22–24
recipes for cooking	70	21–22
use of macaroni wheat	3	29–44
wheat from different countries used	20	15–16
See also Wheat.		
Sewage disposal, use of copper	76	43
Shakutan bamboo	43	34
SHAMEL, ARCHIBALD DIXON, and COBEY, WILLIAM WILFRED, bulletin entitled—		
"Tobacco breeding"	96	1–71
"Varieties of tobacco seed distributed in 1905–6, with cultural directions"	91	1–40
SHEAR, CORNELIUS LOTT, paper entitled "Cranberry spraying experiments in 1905"	100	7–12
Sheep in Algeria	80	89–90
prickly pear for feeding	74	30
raising in south Alaska	82	22–23
Shepherd's-purse seeds, description	84	32
Shocking orchard grass, method used	100	51
Silage alone for milch cows, experiments	82	20–21
Silica, physiological rôle	45	20
Silkworm food plants	34	1–20
Silos in western Oregon and Washington	94	11–13
Silver-top in south Alaska	82	17
Single-germ beet seed, development, *bulletin*	73	1–26

	Bulletin.	Page.
Skinner, Robert P., bulletin entitled "Manufacture of semolina and macaroni"	20	1–31
Skirret, varieties	21	335
Smith, Erwin F., bulletin entitled "The effect of black-rot on turnips: A series of photomicrographs, accompanied by an explanatory text"	29	1–20
and Swingle, Deane Bret, bulletin entitled "The dry-rot of potatoes due to Fusarium oxysporum"	55	1–62
Smoking machine for testing burning quality of cigar tobacco	100	33–35
Sodium bicarbonate, resistance of wheat varieties	79	28–30
		34–36
carbonate, resistance of wheat varieties	79	27–28
		34–36
chlorid in animals	45	26
salt water	72	10–14
resistance of wheat varieties	79	32–33
		34–36
salts, action upon plants	45	30
necessity for animals	45	30
sulphate, resistance of wheat varieties	79	30–32
		34–36
Soft rot of calla lily, *bulletin*	60	1–47
Soil, aeration, effect on nodule formation	100	81–82
conditions, effect on bacteria	100	76–79
erosion, Arizona	67	44–46
inoculation, *bulletin*	71	1–72
paper	72	23–30
	100	73–83
distribution of cultures	71	43–44
for legumes, *bulletin*	71	1–72
results with principal crops	71	44–71
when necessary	71	41–42
	72	24
possibly advantageous	72	24
to expect failure	71	42–43
	72	25
unnecessary	71	41
	72	24–25
transfer	71	20–21
	72	28–29
See also Bacteria, Legumes, and Nitrogen.		
Soiling crops in western Oregon and Washington	94	38
Soils, correction of lime and magnesia content	1	33–35
liming, *paper*	1	9–35
of Algeria	80	38–40
Arizona	67	18–19
California	12	17–18
		25, 55
Oued Souf, Africa	86	18
the Jerid, Tunis	92	33–41
Sahara	53	72–99
various States and countries, analyses	1	18–26
Some diseases of the cowpea, *bulletin*	17	1–38
Sooty-blotch, apple, effect of Bordeaux mixture	93	27
Sorghum in Algeria	80	76–77
Egypt	62	59–60
Nebraska	59	45–46
Texas, central	13	50–51
Sorrel, or sheep's-sorrel, description of seeds	84	36
varieties	21	335
South America, analyses of soils	1	21
Dakota, experiments with hairless Orel red clover	95	27–31
Southern States, recent foreign explorations bearing on agricultural development	35	1–44

	Bulletin.	Page.
Soy bean in Nebraska	59	49
varieties, *bulletin*	98	1–30
Spain, agricultural conditions	27	19–22
almond industry	26	9–13
Spanish almonds and their introduction into America, *bulletin*	26	1–16
Spartina, North American species, *bulletin*	9	1–16
Speedwell, corn, description of seeds	84	36–37
Spermatids, metamorphosis, in Zamia	2	48–50
Spermatogenesis and fecundation of Zamia, *bulletin*	2	1–100
bibliography	2	87–92
summary	2	81–86
of pteridophytes, cycadaceous plants, and Ginkgo, literature	2	7–12
Spermatozoids, movement, in Zamia	2	54–63
structure and form, in Zamia	2	50–54
Spillman, William Jasper, paper entitled "Extermination of Johnson grass"	72	15–22
Spinach, varieties	21	335–340
Spore formation, general considerations	37	28–36
historical review of experiments	37	9–14
methods used in experiments	37	14–15
Phycomyces nitens, *bulletin*	37	1–40
Rhizopus nigricans, *bulletin*	37	1–40
Spraying cranberries with Bordeaux mixture, cost and recommendations	100	11–12
importance of early applications	100	9–10
results	100	8–9
effect on apple diseases	93	15–30
experiments in 1905, cranberry, *paper*	100	7–12
Squash, varieties	21	341–352
Starch, potato	87	9–10
States, Northwestern, grasses and forage plants, *bulletin*	38	1–52
Southwestern, date palm introduction, *bulletin*	53	1–155
Stipa robusta in Nebraska	59	42
Stock food, prickly pear and other cacti, *bulletin*	74	1–48
live, improvement in Washington State	75	24
raising in Alaska	82	21–25
ranges of northwestern California, *bulletin*	12	1–81
Stockberger, Warner W., paper entitled "The drug known as pinkroot"	100	41–44
Storage and germination of wild rice seed, *paper*	90	5–14
apple, experiments	48	15–62
cold, apple, *bulletin*	48	1–66
avocados	77	40–41
function	40	9–10
importance of good fruit	48	26
influence on peach industry	40	23
pear industry	40	11
peach and pear, *bulletin*	40	1–28
difficulties	40	23–24
experiments	40	24–26
pear, behavior on removal	40	20–21
difficulties	40	11–12
experiments	40	12–22
influence on flavor and aroma	40	18–19
temperatures	48	21–22
warehouse, function	48	12–13
warehousing industry, extent	48	10–12
varieties of apples stored, comparison	48	33–34
fruit, purposes	40	10–11
Strontium salts and oxalates, action on animals	45	67–68
in place of calcium salts	45	46–49

	Bulletin.	Page.
Sugar beet, lime and magnesia content	1	33-35
cane in Egypt	62	42-45
Sulla in Algeria	80	83
central Texas	13	64
Sunflower, varieties	21	352
SWINGLE, DEANE BRET, bulletin entitled "Formation of the spores in the sporangia of Rhizopus nigricans and of Phycomyces nitens"	37	1-40
and SMITH, ERWIN F., bulletin entitled "The dry-rot of potatoes due to Fusarium oxysporum"	55	1-62
WALTER TENNYSON, bulletin entitled "The date palm and its utilization in the Southwestern States"	53	1-155
and COOK, ORATOR FULLER, bulletin entitled "Evolution of cellular structures"	81	1-26
Swiss chard, varieties	21	352-353
Switch-grass in Nebraska	59	41

T

	Bulletin.	Page.
Tan bark, Australian wattle	51	21-25
in Algeria	80	95
Tea, propagation	46	19-23
Temperatures, cold, utilization	48	14-15
Tennessee, analyses of soils	1	21
Teosinte in central Texas	13	70-72
Terrell, Tex., work of community demonstration farm, *paper*	51	9-14
Texas, analyses of soils	1	20
central, cattle held on station pastures	13	34-35
cost of cultivating pastures	13	35-37
description of region	13	7-12
hay and pasture plants recommended	13	37-72
range improvement, experiments, *bulletin*	13	1-72
first year's work	13	12-19
grasses and forage plants cultivated	13	24-33
legumes and fodder plants in bales	13	24-25
plan of experiments	13	14-15
second year's work	13	19-26
seeding the ground	13	16-19
seeds, wind blown	13	23-24
selection of land	13	12-14
third year's work	13	26-33
varieties tested	13	19-22
ranges, carrying capacity	13	15-16
weather conditions	13	26-28
date palm suitable	53	134
Thermometers used in moisture determination of grain	99	20
Three new plant introductions from Japan, *bulletin*	42	1-24
Timber burns, seeding, in western Oregon and Washington	94	39
decay and methods of preventing it, *bulletin*	14	1-96
bibliography	14	67
causes	14	16-24
fungi and bacteria	14	18-24
rate	14	19-21
resistance	14	21-23
sawn versus hewn	14	21-22
seasoned versus green	14	22-23
demand and supply	14	9-11
diseases, "bluing" and "red-rot" of the western yellow pine, *bulletin*	36	1-40

	Bulletin.	Page.
Timber diseases, white ash, *bulletin*	32	1–20
impregnation	14	24–95
bibliography	14	67–68
coal-tar treatment	14	53–54
creo-resinate process	14	59–60
creosote treatment	14	49–51
emulsion treatment	14	58–59
experiments in Texas	14	29–32
Ferrell process	14	60
Hasselmann treatment	14	55–58
methods used in Europe	14	40–96
records	14	62–64
recommendations	14	64–67
results in Europe	14	32–39
United States	14	27–32
senilization process	14	58
theory	14	25–26
zinc chlorid treatments	14	51–54
in Algeria	80	93
Arizona	67	19–21
preservation	14	24–96
ties, poles, etc., Europe	14	34–39
See also Pine, Railroads, and Wood.		
Timothy	31	21–22
in Nebraska	59	33–34
western Oregon and Washington	94	25–26
wild, in central Texas	13	53
Nebraska	59	41
Tobacco breeding, *bulletin*	96	1–71
work, field records	96	47–52
permanent records	96	52–54
Algerian, production, quality, etc	80	85–86
Brewer Hybrid variety	96	66–67
cigar, effects of filler, binder, and wrapper on "burn"	100	35–37
filler, tests of "burn"	100	40
method of testing the burning quality, *paper*	100	31–40
tests of burning quality by smoking machine	100	33–35
tests of capacity for holding fire	100	37–40
Connecticut Broadleaf, culture	91	27–29
description	91	12–13
Havana, culture,	25	76–77
	91	20–27
description	91	12
Cooley Hybrid variety	96	64–66
Cuban, culture	91	29–30
description	91	13
cultural directions	25	72–81
accompanying varieties of seed distributed in 1905–6, *bulletin*	91	1–40
description of varieties	91	11–15
disease resistance	96	60–62
Florida Cuban	25	75–76
Sumatra	25	72–75
flowers, structure and arrangement	96	17–21
importance of large and heavy seed	96	57–60
improvement of burning quality	96	39–44
Kentucky White Burley	25	79–80
leaf ash, lime and magnesia content	1	27
Little Dutch, culture	91	30
description	91	14
Maryland Smoking, culture	25	78–79
	91	31–32
description	91	14

	Bulletin.	Page.
Tobacco, mosaic disease, *bulletin*	18	1–24
artificial production	18	12–16
historical summary	18	7–11
infection	18	16–17
preventive measures	18	22–24
translocation of starch	18	11–12
zymogen for oxidase and peroxidase	18	17–22
new variety produced by seed selection	96	62–64
North Carolina Bright Yellow, culture	25	77–78
	91	32–33
description	91	14
Ohio Zimmer Spanish, culture	25	77
Orinoco, description	91	15
plant, insect enemies	91	34
number of seeds produced	96	21
plants, control of number of leaves	96	33–35
great variability	96	9–12
improvement of shape of leaves	96	26–29
modification of size of leaves	96	29–33
production of early varieties	96	37–39
nonsuckering types	96	35–37
seed, directions for saving	91	34–37
	96	54–57
distributed, varieties, with cultural directions, *bulletin*	91	1–40
how to secure good quality	91	37–38
plan of distribution	25	70–72
separation	96	57–60
seeds, number produced	96	21
selection of seed plants	96	44–54
soils, lime and magnesia content	1	27–28
Sumatra, culture	91	15–20
description	91	12
Tennessee types, culture	25	79
	91	32–33
Uncle Sam Sumatra variety, history and description	96	62–64
uses of different varieties	25	82
varieties, introduction and acclimatization	96	12–17
Virginia types, culture	25	80–81
	91	32–33
description	91	15
White Burley, culture	91	33–34
description	91	14–15
wilt disease, description and cause	51	5–6
control	51	6–8
Yellow Mammoth, description	91	15
Zimmer Spanish, culture	91	30
description	91	13
Tobaccos, cigar-filler, descriptions	91	13–14
cigar-wrapper, descriptions	91	12–13
pipe, descriptions	91	14
plug, descriptions	91	14–15
Tomato, varieties	21	353–371
TOWNSEND, CHARLES ORRIN, bulletin entitled "A soft rot of the calla lily"	60	1–47
and RITTUE, EDWARD COOPER, bulletin entitled "The development of single-germ beet seed"	73	1–26
Toxic salts, resistance of wheat varieties, experiments, *bulletin*	79	1–48
TRACY, WILLIAM WOODBRIDGE, Jr., bulletin entitled "A list of American varieties of peppers"	6	1–19

	Bulletin.	Page.
Tracy, William Woodbridge, Jr., bulletin entitled "American varieties of lettuce"	69	1–103
"List of American varieties of vegetables for the years 1901 and 1902"	21	1–402
Trees, Central American rubber, culture, *bulletin*	49	1–86
citrus, diseases, *bulletin*	52	1–22
fruit, frozen in 1904, *paper*	51	15–19
tropical, propagation, *bulletin*	46	1–28
shade, Kafir plum	25	18
white ash, disease, *bulletin*	32	1–20
Tropical fruit trees, propagation, *bulletin*	46	1–28
Truck crops in Algeria	80	71–73
Tunis, atmospheric humidity	92	26–27
climate	92	21–28
date varieties and date culture, *bulletin*	92	1–112
geography	92	11–21
irrigation system	92	28–33
precipitation	92	27–28
soils	92	33–41
temperature	92	21–26
Turnip, flat or fall, in western Oregon and Washington	94	38
garden, varieties	21	371–383
ruta-baga, varieties	21	383–391
Turnips, black-rot, *bulletin*	29	1–20
Typhoid fever germs, effect of copper	64	28–34
	76	38–47
		51–54
	100	57–71

U

	Bulletin.	Page.
Udo, a new winter salad	42	17–20
kan, cultivation	42	18–19
moyashi, cultivation	42	19–20
Unalaska and neighboring islands, vegetation	82	12–13
Uncle Sam Sumatra tobacco, history and description	96	62–64
United States, wild medicinal plants, *bulletin*	89	1–76
Uredo of Kentucky bluegrass rust	63	20
Puccinea montanensis	63	20–21
winter resistance	63	19–21

V

	Bulletin.	Page.
Van Tieghem cells, stand	16	42–43
Variability of wheat varieties in resistance to toxic salts, *bulletin*	79	1–48
Varieties, American, lettuce, *bulletin*	69	1–103
peppers, *bulletin*	6	1–19
vegetables, *bulletin*	21	1–402
cotton	25	47–59
dates in Oued Souf	86	25–26
Tunis, *bulletin*	92	1–112
on Persian Gulf, *bulletin*	54	1–32
fungi, *bulletin*	8	1–31
medicinal plants, wild, *bulletin*	89	1–76
soy beans, *bulletin*	98	1–30
tobacco seed distributed in 1905-6, with cultural directions, *bulletin*	91	1–40

	Bulletin.	Page.
Vegetables, American varieties, lettuce, *bulletin*	69	1–103
miscellaneous, *bulletin*	21	1–402
nomenclature	21	8–10
peppers, *bulletin*	6	1–19
Velvet grass in Northwestern States	31	23
western Oregon and Washington	94	28–29
Vermifuge, pinkroot, *paper*	100	41–44
Vermont Agricultural Experiment Station, work on potatoes	87	32–33
Vetch, common, in western Oregon and Washington	94	18–21
methods of making hay	94	19–20
sowing	94	18
seed crop	94	20–21
soiling	94	18–19
hairy, results of inoculation	71	68–69
in Algeria	80	83–84
Nebraska	59	50
Northwestern States	31	26
Texas, central	13	65
pearl, in western Oregon and Washington	94	22
Vitality and germination of seeds, *bulletin*	58	1–96
of buried seeds, *bulletin*	83	1–22
VON SCHRENK, HERMANN, bulletin entitled "A disease of the white ash caused by Polyporus fraxinophilus"	32	1–20
"The 'bluing' and the 'red-rot' of the western yellow pine, with special reference to the Black Hills Forest Reserve"	36	1–40
"The decay of timber and methods of preventing it"	14	1–96
and HEDGCOCK, GEORGE GRANT, paper entitled "The wrapping of apple grafts and its relation to the crown-gall disease"	100	13–20
and SPAULDING, PERLEY, bulletin entitled "The bitter-rot of apples"	44	1–54

W

	Bulletin.	Page.
WAITE, MERTON BENWAY, paper entitled "Fruit trees frozen in 1904"	51	15–19
Walker, Dr. Arthur de Noé, quotation from pamphlet on use of copper in epidemic of cholera	76	52–54
Wasabi, the horse-radish of the Japanese, *paper*	42	20–22
cultivation	42	21–22
Washington, eastern, forage conditions, *bulletin*	38	1–52
experiment station, cooperative experiments in range management, *bulletin*	75	1–28
grasses and forage plants, index	75	25–26
improvement of live stock	75	24
Oregon, California, and Nevada, alfalfa	38	28–29
brome-grass, awnless	38	32
cheat	38	34
description of region	38	11–15

	Bulletin.	Page.
Washington, Oregon, California, and Nevada, grasses and forage plants, index	38	47–51
grasses, native, worthy of cultivation	38	45
hay, grain	38	33–34
native	38	35–36
meadows and hay crops	38	27–36
ranges, abuses	38	44–45
conditions and plants	38	15–27
root crops	38	34
swamp land reclamation	38	36–37
timothy and redtop	38	29–31
range management, *bulletin*	75	1–28
ranges, alternation of pastures	75	23–24
experiments in reseeding	75	16–20
improvements	75	13–20
mountain grazing areas	75	17–20
protection of pastures	75	20–23
semiarid lands	75	15–17
use of pastures too early in spring	75	24
winter pastures	75	13–15
western, forage crops, *bulletin*	94	1–39
rainfall, etc	94	8–9
Water bacteria, effect of copper, *paper*	100	57–71
cress beds, eradication of algæ	64	26–27
	76	48
for live stock, Arizona	67	34–38
in grain, method of determining, *bulletin*	99	1–24
microscopical examination	64	9–10
	76	31–32
odor and taste caused by dead algæ	76	13, 32
salt, method of testing salinity	72	10–11
sea, content of soluble salts	1	13–14
sterilization with copper	64	28–38
	76	38–44
supplies, algæ and bacteria, eradication, *bulletin*	64	1–44
	76	1–55
supply in the Jerid, Tunis	92	28–31
Wattle, Australian, cultivation, *paper*	51	21–25
WEBBER, HERBERT JOHN, bulletin entitled "Spermatogenesis and fecundation of Zamia"	2	1–100
and ORTON, WILLIAM ALLEN, paper entitled "A cowpea resistant to root-knot (Heterodera radicicola)"	17	23–38
Weed seeds in bluegrass seeds, descriptions	84	32–38
Weeds in Arizona	67	58–59
Nevada and Oregon	15	38–41
Weevil-resisting adaptations of the cotton plant, *bulletin*	88	1–87
Weights per bushel of seeds, *paper*	51	27–33
West Indies, avocados	77	14
Castilla (rubber) culture	49	16–17
letters on agriculture	27	9–12
WESTGATE, JOHN MINTON, bulletin entitled "Reclamation of Cape Cod sand dunes"	65	1–38
Wheat, Adjini variety, description	7	44
Aicha el Beida variety, description	7	20
Algerian durum varieties, descriptions, *bulletin*	7	1–48

	Bulletin.	Page.
Wheat, analyses	70	33
	78	17–120
Aures variety, description	7	46
Azazi variety, description	7	40
Beliouni variety, description	7	26
Beloturka variety, description	3	50
	7	22
Boghar variety, description	7	32
breeding	78	49–120
Caïd de Siouf variety, description	7	28
Eleuze variety, description	7	38
characters of grain	7	10–11
classification and descriptions, basis	7	8–11
object	7	7–8
conditions affecting composition and yield	78	17–46
climate	78	20–23
soil	78	23–29
soil moisture	78	29–30
time of cutting	78	17–20
yield, immature seed	78	20
specific gravity of seed kernel	78	37–39
containing garlic, cost of separation	100	26–28
experiments in separating	100	22–26
loss resulting	100	21–22
quantity before and after separation	100	26
Courtellement variety, description	7	20
cultivation in alfalfa fields, *paper*	72	5–7
description of varieties, *bulletin*	47	1–19
Algerian durum, *bulletin*	7	1–48
durum, *bulletin*	3	1–62
durum, adaptability to semiarid districts of United States	3	13–28
Algerian varieties, *bulletin*	7	1–48
Arnautka variety, description	3	48–49
Beloturka variety, description	3	50
Black Don variety, description	3	51
Candeal variety, description	3	53
characteristics	3	10–11
	7	12–13
climate, comparisons	3	13–18
effects	3	47
commercial status, *bulletin*	70	1–70
cultivation	3	45–47
demand, foreign	3	29–40
home	3	38–40
determination of best varieties	70	66–67
disposal of crop	70	67–68
distribution	3	11–13
experiments in growth	3	19–20
for bread	3	44–45
	20	29
	70	31–65
macaroni	3	29–44
	20	11–12
	70	13–31
miscellaneous uses	70	65
semolina	3	29–44
	20	11–12
Gharnovka variety, description	3	47–48
harvesting	3	46–47
increase in mills	70	68
production	70	66

	Bulletin.	Pag
Wheat, durum, industry, outlook for future	70	66-
progress and development	70	65-
inspection and grading	70	6
Kubanka variety, description	3	4
market	3	28-4
	20	7-
		12-1
Medeah variety, description	3	52-5
Missogen variety, description	3	5
name "durum"	70	12-1
Nicaragua variety, description	3	5
Pellissier variety, description	3	5
Pererodka, variety, description	3	49-5
Polish variety, description	3	5
prices	70	6
qualities of commercial value	70	1
quality demanded	3	33-3
rank assigned wheats of this type	70	9-1
Russo-Mediterranean traffic	3	58-6
Sarui-Bugda variety, description	3	5
seeding	3	4
soil, comparison	3	18-1
effects	3	4
preparation	3	45-4
varieties	3	47-5
comparison	3	56-5
Velvet Don variety, description	3	50-5
Wild Goose variety, description	3	54-5
for macaroni	20	12-1
winter varieties	3	55-5
effect of drying	100	28-2
		29-3
El Aoudja variety, description	7	3
Hamra variety, description	7	4
Safra variety, description	7	4
French metadiné, for macaroni	20	9-1
garlicky, *paper*	100	21-3
glossary of terms used in descriptions of Algerian varieties	7	11-1
grasses in Nebraska	59	37-3
Hached variety, description	7	3
head, structure	7	9-1
improvement in quality of gluten	78	91-9
improving the quality, *bulletin*	78	1-12
in Algeria	7	7-4
	80	74-7
Egypt	62	51-5
investigations to improve quality, object	78	13-1
Kahla variety, description	7	2
kernel, properties	78	49-7
selection to increase quantity of proteids	78	76-8
selection to increase quantity of proteids in endosperm	78	84-91
macaroni, *bulletin*	3	1-6
Algerian, *bulletin*	7	1-4
commercial status, *bulletin*	70	1-7
machinery for drying and cleaning	100	3
Maroc variety, description	7	4
Medeah variety, description	3	52-5
	7	2
Medeba variety, description	7	3
Meskiana variety, description	7	3
Mohamed Ben Bachir variety, description	7	3
Moroccain variety, description	7	4
M'Saken variety, description	7	3

	Bulletin.	Page.
Wheat, Nab el Bel variety, description	7	48
nitrogen content, conditions affecting	78	40–46
effect of length of growing period	78	104–111
relation of size of kernel	78	35–37
specific gravity of kernel	78	39–40
yield affected by length of growing period	78	104–111
to the acre	78	72–76
Ouchda variety, description	7	42
Paros variety, description	7	24
Pelissier variety, description	3	53
	7	38
Poulot variety, description	7	24
relation of size of head to yield, height, and tillering of plant	78	111–118
resistance to toxic salts, bibliography	79	47–48
experiments, *bulletin*	79	1–48
individual variability of varieties	79	37–39
method of establishing toxic limits	79	21–23
methods of experiments	79	16–20
results of experiments	79	23–35
practical value	79	44–45
with magnesium—		
chlorid	79	25–26
sulphate	79	23–25
with sodium—		
bicarbonate	79	28–30
carbonate	79	27–28
chlorid	79	32–35
sulphate	79	30–32
summary of results of experiments	79	34–35
varieties tested	79	11–16
Budapest	79	15
Chul	79	14–15
Kharkof	79	14
Kubanka	79	15–16
Maraouani	79	16
Padui	79	14
Preston	79	12–13
Turkey	79	13
Zimmerman	79	13–14
results of breeding to increase content of proteid nitrogen	78	95–100
Saragolla, *paper*	25	9–12
seedlings, analyses of ash constituents	79	37
semolina	25	9–12
cleaning	20	16–20
milling process	20	20–22
scouring	20	14–15
sown with red clover	94	15
Tesdouni variety, description	7	34
Trimenia variety, description	7	30
varieties, description, terms used, *bulletin*	47	1–18
nomenclature	47	9–18
vitality, effect of drying	100	29–30
Wild Goose variety, description	3	54–55
for macaroni	20	12–13
Xeres variety, description	7	22
yield as affected by susceptibility to cold	78	100–104
length of growing period	78	104–111
Zedouni variety, description	7	44
White-rot of white ash, *bulletin*	32	1–20

	Bulletin.	Page.
Whitetop grass in central Texas	13	52
Wild medicinal plants of the United States, *bulletin*	89	1–76
rice: Its uses and propagation, *bulletin*	50	1–24
seed, storage and germination, *paper*	90	5–14
Willow rusts	63	18–19
Wilt disease of tobacco and its control, *paper*	51	5–8
Wither-tip and other diseases of citrus trees and fruits, *bulletin*	52	1–22
Wood, cells and fibers	14	12–14
life	14	14–15
chemical nature	14	14
dead, ash, microscopic changes	32	14–17
decay, bibliography	14	67
causes, rate of resistance	14	16–24
diseased, ash, growth of fungus	32	17
heartwood and sapwood	14	15–16
impregnation	14	24–96
mechanical nature	14	14
resistance to decay of different races	14	23
structure	14	12–16
western yellow pine, "bluing" and "red-rot," *bulletin*	36	1–40
See also Pine, Railroads, and Timber.		
Woods, Albert Fred, bulletin entitled "Observations on the mosaic disease of tobacco and its control"	18	1–24
paper entitled "Inoculation of soil with nitrogen-fixing bacteria"	72	23–30
Work of the community demonstration farm at Terrell, Tex., *paper*	51	9–14
Wrapping of apple grafts and its relation to the crown-gall disease, *paper*	100	13–20

Y

Yakutat plains, Alaska, grass lands	82	14–15
Yam cultivation, Jamaica	27	12–15

Z

Zamia, development of microspores	2	16–19
pistillate cones	2	19–22
pollen tube and prothallus	2	22–39
division of central cell	2	39–48
fecundated egg cell	2	69–70
is the blepharoplast a centrosome?	2	70–81
metamorphosis of the spermatids	2	48–50
methods and materials used in investigation	2	12–16
movement of spermatozoids	2	54–63
process of fecundation	2	63–69
spermatogenesis and fecundation, *bulletin*	2	1–100
structure and form of mature spermatozoid	2	50–54

101

O

THE PHILADELPHIA
DEC 20 1907
MUSEUMS

U. S. DEPARTMENT OF AGRICULTURE,
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B. T. GALLOWAY, *Chief of Bureau.*

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CONTENTS.

BULLETIN No. 102.—MISCELLANEOUS PAPERS. Page.

Summary of recent investigations of the value of cacti as stock food 7
  Introduction 7
  The samples of cacti analyzed 8
  Water content 8
  Ash content 9
  Food value of different parts of the plant 11
  A balanced ration of prickly pear 12
  Relative value of the three groups of cacti 14
  Common and scientific names 15
  Climatic requirements of prickly pears 16
  The use of prickly pear in Mexico 17
  The species of cacti and their analyses 17
A successful dairy farm 19
  Introduction 19
  The rotation followed 20
  Harvesting the hay 21
  Feed for the cows and calves 22
  Butter production 23
  Poultry production 23
  Results achieved 23
Planning a cropping system 25
  Introduction 25
  Farm selected to illustrate the methods used in planning a cropping system 27
    The rotations adopted 29
  Arrangement of cropping systems for farms 31
The application of vegetative propagation to leguminous forage plants 33
  Introduction 33
  Description of the method employed in the vegetative propagation of leguminous plants 34
  Application of the method to practical plant-breeding problems 35
The control of Texas root-rot of cotton 39
  Introduction 39
  Cause of root-rot 39
  Efforts to control the disease 40
  Rotation of crops 40
  Aeration of the soil by deep plowing 40
    Deep fall plowing 40
    Deep spring plowing and subsoiling 41
  Treatment recommended 41
The history of the cowpea and its introduction into America 43
  Introduction 43
  History 44
A new method for the determination of nicotine in tobacco 61
  The relation of nicotine to the quality of tobacco 61
  The quantitative determination of nicotine in tobacco 62
  The proposed new method 64
    Preliminary experiments 64
    Description of the method 66

BULLETIN NO. 102.—MISCELLANEOUS PAPERS—Continued.

Page
Comparison of the new method with that of Kissling 65
Conclusion 68
Index 71

BULLETIN NO. 103.—DRY FARMING IN THE GREAT BASIN.

Introduction 7
Location and general description of the region 9
Experiments in dry farming in the Great Basin 11
    Private experiments in dry farming 13
    The Utah arid experiment farms 14
Local conditions which affect dry farming 15
    Precipitation mainly in winter 16
    Annual variation in rainfall 18
    Influence of local topography on rainfall 18
Methods of interseason tillage 22
    Maintenance of a clean summer fallow 24
    The importance of soil texture 25
Crops and crop tillage 27
    Tillage for wheat 28
    Tillage for alfalfa 29
    Thin seeding essential to best results 30
The sustained productiveness of dry-farmed soils 31
    The heavy soils not leached 32
    The importance of organic matter in the soil 33
    Conditions favoring nitrification 33
    The fixation of nitrogen 34
    Organic matter lost by oxidation 35
Dry farming supplementary to irrigation 35
Making a home on the dry lands 36
Summary 38
Description of plates 40
Index 41

BULLETIN NO. 104.—THE USE OF FELDSPATHIC ROCKS AS FERTILIZERS.

Introduction 7
The availability of potash in ground rock 11
The effect of fineness of grinding 26
Cost of ground feldspar 28
Possible harmful effects of ground feldspar 30
Extraction of potash from ground rock 30
Conclusion 31
Index 32

BULLETIN NO. 105.—THE RELATION OF THE COMPOSITION OF THE LEAF TO THE BURNING QUALITIES OF TOBACCO.

Introduction 7
Effects of the various constituents of the ash on the burning qualities of tobacco 14
    Potassium 15
    Calcium 16
    Magnesium 17
    Mineral and organic acids 18
The character of the ash 21
The relation of the organic constituents to the burning qualities 22
Summary 24
Index 27

BULLETIN NO. 106.—SEEDS AND PLANTS IMPORTED DURING THE PERIOD FROM DECEMBER, 1905, TO JULY, 1906. INVENTORY NO. 12; NOS. 16797 TO 19057.

Page.
Introductory statement 5
Inventory of seeds and plants imported 7
Index of common and scientific names 115

BULLETIN NO. 107.—AMERICAN ROOT DRUGS.

Introduction 9
The collection of root drugs 10
Plants furnishing root drugs 11
  Male-fern (*Dryopteris filix-mas* and *D. marginalis*) 11
  Couch-grass (*Agropyron repens*) 12
  Wild turnip (*Arisaema triphyllum*) 13
  Skunk-cabbage (*Spathyema foetida*) 15
  Sweet-flag (*Acorus calamus*) 16
  Chamaelirium, or Helonias (*Chamaelirium luteum*) 17
  American hellebore (*Veratrum viride*) 18
  Aletris (*Aletris farinosa*) 19
  Bethroot (*Trillium erectum*) 20
  Wild yam (*Dioscorea villosa*) 21
  Blue flag (*Iris versicolor*) 22
  Lady's-slipper (*Cypripedium hirsutum* and *C. parviflorum*) 23
  Crawley-root (*Corallorhiza odontorhiza*) 24
  Canada snakeroot (*Asarum canadense*) 25
  Serpentaria (*Aristolochia serpentaria* and *A. reticulata*) 26
  Yellow dock (*Rumex crispus*) 27
  Pokeweed (*Phytolacca decandra*) 29
  Soapwort (*Saponaria officinalis*) 31
  Goldenseal (*Hydrastis canadensis*) 31
  Goldthread (*Coptis trifolia*) 34
  Black cohosh (*Cimicifuga racemosa*) 35
  Oregon grape (*Berberis aquifolium*) 36
  Blue cohosh (*Caulophyllum thalictroides*) 37
  Twinleaf (*Jeffersonia diphylla*) 38
  May-apple (*Podophyllum peltatum*) 39
  Canada moonseed (*Menispermum canadense*) 40
  Bloodroot (*Sanguinaria canadensis*) 40
  Hydrangea (*Hydrangea arborescens*) 41
  Indian-physic (*Porteranthus trifoliatus*) 42
  Wild indigo (*Baptisia tinctoria*) 43
  Crane's-bill (*Geranium maculatum*) 44
  Seneca snakeroot (*Polygala senega*) 45
  Stillingia (*Stillingia sylvatica*) 47
  Wild sarsaparilla (*Aralia nudicaulis*) 48
  Ginseng (*Panax quinquefolium*) 49
  Water-eryngo (*Eryngium yuccifolium*) 50
  American angelica (*Angelica atropurpurea*) 51
  Yellow jasmine or jessamine (*Gelsemium sempervirens*) 51
  Pinkroot (*Spigelia marilandica*) 52
  American colombo (*Frasera carolinensis*) 53
  Black Indian hemp (*Apocynum cannabinum*) 55
  Pleurisy-root (*Asclepias tuberosa*) 56
  Comfrey (*Symphytum officinale*) 57
  Stoneroot (*Collinsonia canadensis*) 58

BULLETIN NO. 107.—AMERICAN ROOT DRUGS—Continued. Page.

Culver's-root (*Veronica virginica*) 59
Dandelion (*Taraxacum officinale*) 60
Queen-of-the-meadow (*Eupatorium purpureum*) 61
Elecampane (*Inula helenium*) 62
Echinacea (*Brauneria angustifolia*) 63
Burdock (*Arctium lappa*) 64
Explanation of plates 68
Index 69

BULLETIN NO. 108.—THE COLD STORAGE OF SMALL FRUITS.

Introduction 7
Outline of experiments in small-fruit storage 10
The influence of soil and climatic conditions on the keeping quality of small fruits 11
The influence of the time of picking on the keeping quality of small fruits 12
Storage house temperatures for small fruits 12
The freezing of small fruits in cold storage 13
The influence of the type of package on the keeping quality of small fruits 14
Composition of the air in different types of packages 15
The influence of the wrapper on the keeping quality of small fruits 17
The influence of oxygen gas on the keeping quality of small fruits 18
The influence on the keeping quality of careful handling and of storing small fruits soon after picking 19
The length of time small fruits keep in cold storage 20
The behavior of small fruits when withdrawn from cold storage 21
Summary 21
Description of plates 26
Index 27

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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 102.

B. T. GALLOWAY, *Chief of Bureau.*

MISCELLANEOUS PAPERS.

I. SUMMARY OF RECENT INVESTIGATIONS OF THE VALUE OF CACTI AS STOCK FOOD.

By DAVID GRIFFITHS, *Assistant Agrostologist,*
and R. F. HARE, *Chemist, New Mexico College of Agriculture and Mechanic Arts.*

II. A SUCCESSFUL DAIRY FARM.

By L. G. DODGE, *Scientific Assistant.*

III. PLANNING A CROPPING SYSTEM.

By W. J. SPILLMAN, *Agriculturist.*

IV. THE APPLICATION OF VEGETATIVE PROPAGATION TO LEGUMINOUS FORAGE PLANTS.

By J. M. WESTGATE, *Assistant Agrostologist,*
and GEORGE W. OLIVER, *Plant Propagator.*

V. THE CONTROL OF TEXAS ROOT-ROT OF COTTON.

By C. L. SHEAR. *Pathologist,*
and GEORGE F. MILES, *Scientific Assistant.*

VI. THE HISTORY OF THE COWPEA AND ITS INTRODUCTION INTO AMERICA.

By W. F. WIGHT, *Assistant Botanist.*

VII. A NEW METHOD FOR THE DETERMINATION OF NICOTINE IN TOBACCO.

By WIGHTMAN W. GARNER, *Scientific Assistant.*

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Cotton Culture Farms, Seaman A. Knapp, Lake Charles, La., Special Agent in Charge.

Editor, J. E. Rockwell.
Chief Clerk, James E. Jones.

CONTENTS.[a]

Page.
mmary of recent investigations of the value of cacti as stock food.......... 7
  Introduction.......... 7
  The samples of cacti analyzed.......... 8
  Water content.......... 8
  Ash content.......... 9
  Food value of different parts of the plant.......... 11
  A balanced ration of prickly pear.......... 12
  Relative value of the three groups of cacti.......... 14
  Common and scientific names.......... 15
  Climatic requirements of prickly pears.......... 16
  The use of prickly pear in Mexico.......... 17
  The species of cacti and their analyses.......... 17
successful dairy farm.......... 19
  Introduction.......... 19
  The rotation followed.......... 20
  Harvesting the hay.......... 21
  Feed for the cows and calves.......... 22
  Butter production.......... 23
  Poultry production.......... 23
  Results achieved.......... 23
lanning a cropping system.......... 25
  Introduction.......... 25
  Farm selected to illustrate the methods used in planning a cropping system. 27
    The rotations adopted.......... 29
  Arrangement of cropping systems for farms.......... 31
he application of vegetative propagation to leguminous forage plants.......... 33
  Introduction.......... 33
  Description of the method employed in the vegetative propagation of leguminous plants.......... 34
  Application of the method to practical plant-breeding problems.......... 35
he control of Texas root-rot of cotton.......... 39
  Introduction.......... 39
  Cause of root-rot.......... 39
  Efforts to control the disease.......... 40
  Rotation of crops.......... 40
  Aeration of the soil by deep plowing.......... 40
    Deep fall plowing.......... 40
    Deep spring plowing and subsoiling.......... 41
  Treatment recommended.......... 41

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[a] The seven papers constituting this bulletin were issued in separate form on January 4, January 30, March 14, March 23, March 30, June 10, and July 6, 1907, respectively.

The history of the cowpea and its introduction into America
- Introduction
- History

A new method for the determination of nicotine in tobacco
- The relation of nicotine to the quality of tobacco
- The quantitative determination of nicotine in tobacco
- The proposed new method
  - Preliminary experiments
  - Description of the method
- Comparison of the new method with that of Kissling
- Conclusion

Index

ILLUSTRATIONS.

PLATES.

Page.

PLATE I. Nopal cardon (*Opuntia streptacantha* Lehm.), the most important of the Mexican prickly pears.......... 14

II. Fig. 1.—View across the lower end of the McDonald farm, showing the buildings, the dwelling house being partially concealed in the trees. Fig. 2.—View across the upper end of the farm, showing the stony nature of the land in the pasture, the present condition of the hay land, and the location of the mill pond.......... 20

III. Fig. 1.—Cuttings of Peruvian alfalfa before and after rooting. Fig. 2.—Cuttings of Peruvian alfalfa rooted in sand in greenhouse..... 34

IV. Fig. 1.—Potted cuttings of Peruvian alfalfa in greenhouse. Fig. 2.—Potted cuttings of Peruvian alfalfa in cold frames.......... 34

V. Fig. 1.—Rooted cuttings of Peruvian alfalfa ready for transplanting to permanent nursery rows. Fig. 2.—Plants from cuttings of Peruvian alfalfa in permanent nursery rows.......... 34

VI. Plant of *Vigna catjang* (Burm.) Walp.......... 54

VII. Plant of *Vigna unguiculata* (L.) Walp.......... 54

VIII. Pods of cowpeas. A.—*Vigna unguiculata.* B.—*Vigna catjang.* (Natural size).......... 54

TEXT FIGURES.

FIG. 1. Plan of farm as submitted by the manager for the recommendation of a suitable cropping system 27

2. Final arrangement of the several fields, showing the cropping system recommended 30

3. Cotton field badly infested with the root-rot, showing the result of spring subsoiling.......... 41

PHILADELPHIA
DEC 20 1907

P. I.—304.

MISCELLANEOUS PAPERS

P. I.—242.

UMMARY OF RECENT INVESTIGATIONS OF THE VALUE OF CACTI AS STOCK FOOD.[a]

r **David Griffiths**, *Assistant Agrostologist, Farm Management Investigations, Bureau of Plant Industry*, and **R. F. Hare**, *Chemist, New Mexico College of Agriculture and Mechanic Arts.*

INTRODUCTION.

In connection with introductions, the improvement of species, and general study of the economic relationships of native and introuced species of cacti the authors have jointly undertaken a somewhat itical comparison of the species of this group from a forage standoint. In order to make the chemical work worth while it has been ecessary to put the characterizations of the different forms and ecies in such condition that they are recognizable to others. This ould only be done by the use of copious notes in connection with ach, for names are of uncertain meaning and in many cases will be f uncertain significance in this group of plants for a long time to ome. The chemical side of the investigations seems to be essential, r when these studies were begun there was but little literature dealng with the cacti from a forage standpoint.

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[a] In two publications of the United States Department of Agriculture (Bulletin o. 74 of the Bureau of Plant Industry and Bulletin No. 91 of the Bureau of Animal ndustry) the value of the cacti as forage plants has been demonstrated. Since these lants are known to possess important economic value more knowledge concerning hem is desirable. As a basis for future investigations, the Bureau of Plant Industry nd the Agricultural Experiment Station of New Mexico have collected specimens of hese plants and their fruits from a wide area, from which a large number of chemical nalyses have been made. The results are detailed in the following pages, which ontain 187 fodder analyses and 26 complete ash analyses. The territory from which he material was collected extends from central Texas to California and southward to he central plateau of Mexico.

Attention is called to the fact that the apparent high content of fats and protein in he fruit of certain species is due to the large amount of these classes of nutrients found n the seed. As these seeds are surrounded by a dense layer of wholly indigestible issue, the high content of ether extract and protein is misleading. The analyses how that the fodder value of the fruit of cholla (*Opuntia fulgida*) especially is little more than that of the stems. It will be seen that in chemical composition the different orms of cactus compare favorably with ordinary green fodders and root crops.

There are many points of special interest in connection with the ash analyses, particularly the high content of potash, magnesium, and calcium. Although the cane cacti show a relatively higher food value, practical considerations relating to growth and ease of propagation render them of less value than the prickly pear, except in certain limited localities where they are especially abundant.—W. J. Spillman, *Agriculturist in Charge of Farm Management Investigations.*

The investigations have been conducted in cooperation between the Office of Farm Management Investigations of the Bureau of Plant Industry and the Agricultural Experiment Station of New Mexico for the purpose of determining, if possible, the extent of variation and the nature of the food constituents of the different species which are likely to be utilized as food for stock. The plants are grouped under three general headings—prickly pears, cane cacti, and miscellaneous—the first group being by far the most important, though the second is largely utilized in sections where its different representatives grow. Three or four members of this group have been fed to stock with more or less success. The third group consists of miscellaneous species from other cactus genera, which on the whole are but little utilized as stock feed, although it is clearly shown that some of the species have been fed in rare instances. The interest in this group is largely a matter of comparison with the others.

Details of the investigations are published in Bulletin No. 60 of the Agricultural Experiment Station of New Mexico.

THE SAMPLES OF CACTI ANALYZED.

Considerable importance is attached to the method of sampling, it being recognized that uniform samples of such succulent and variable plants are difficult to secure. It appeared more logical, therefore, to describe the samples in such a way as to give other investigators and the reader an accurate idea of the portion of the plant used in the chemical analysis. The sample is indicated by a formula—for example (2–1–4–3–5) 3—in which the left-hand figure indicates the number of terminal joints, the second number from the left the number of joints next to the terminal joint, and so on, the figure outside of the parentheses indicating the number of plants from which the sample was collected. All samples were forwarded to the laboratory in tin cans from which a minimum of evaporation took place. They were prepared by first being sliced open, so as to expose a maximum of cut surface, and dried by artificial heat at a temperature of not more than 70° C. The spines were then singed off by a small flame of complete combustion, care being taken neither to deposit combustion products upon nor injure the specimens. In the analyses the methods of the Association of Official Agricultural Chemists were followed, with the exception of a few modifications in the determination of certain ash constituents.

WATER CONTENT.

A collection of samples for chemical analysis was begun in 1904, and a fairly complete set was secured during that year; but, owing to the uncertainty due to the analysis of single samples, these were nearly all duplicated in 1905, in most cases from the same localities.

Fortunately there was a great difference between the rainfall during the months from January to March of 1904 and 1905. The effect upon the water content of the plants is fairly well illustrated in the different tables of analyses, although no special effort was made to collect the samples for the purpose of showing this feature in detail. There are some apparent exceptions to the rule that the samples collected in 1904 contain more water than those collected in 1905; but this may be accounted for in some cases by the difference in the portions of plant collected or in other cases possibly by local conditions. The amount of water in the different samples analyzed varied from 60.99 to 95.5 per cent. The miscellaneous group is relatively more succulent than either of the other two, the average amount of water being 87.88 per cent, while the prickly pears averaged 84.26 per cent and the cane cacti 78.47 per cent. As a rule, the fruit contained more water than the stems and the younger growth more than the older.

The difference in the species in the field during a dry and a wet season is very marked, and even prickly pear has its limit of drought endurance. Experience in southern Texas demonstrates that it is much reduced in value during very prolonged dry seasons, for it becomes tough and leathery. "Fat pear" is largely the result of distention of the tissues by water. Some species, *Opuntia fulgida* especially, when a favorable moist season follows an exceptionally dry one, will absorb so much water that the fruits and young joints become ruptured by the excessive turgidity, and this often occurs with the fruit of nopal camueso and other cultivated Mexican species.

ASH CONTENT.

Plants grown in the arid and semiarid Southwest, where there is an abundance of soluble salts in the soil, are found to contain more ash than those grown in regions of frequent rainfall. The cacti are certainly no exceptions to this rule. The average ash in the air-dried stems and fruits of the prickly pears analyzed amounts to 18.25 per cent, for the cane cacti 15.50 per cent, and for the miscellaneous group 13.54 per cent, one sample running as high in ash as 33.8 per cent of the air-dried substance. These averages would be still higher if they did not include the ash of fruits, which always contain less ash than the stems. The average ash in the air-dried fruits of the prickly pears, for instance, is 13.21 per cent, which is 5.4 per cent less than is contained in an average of both stems and fruits of this group and 6.35 per cent less than is in the stems alone. It is the seed which is especially low in ash, the fleshy portion resembling the stem more closely so far as its ash content is concerned. This is brought out very forcibly in samples Nos. 8022*a* and 8022*b*, the former being the fleshy portion and the latter the seed of *Opuntia phaeacantha*. The fleshy portion contained 25.60 per cent of ash, while the seed contained only 1.77 per cent.

The elements of the ash are present in about the same proportion as in the ash of other plants, except potassium, magnesium, and calcium, which are found in large amounts. It is probably the presence of these salts, coupled with the high water content, that causes cattle to scour when fed on an exclusive roughage ration of these plants.

In the following table there is given a complete analysis of the ash of a few of the samples, together with the results of the analysis of a composite sample, and an average of all the ash analyses made. Complete ash analyses were made of 26 samples besides the composite, which was a mixture prepared by carefully igniting in a muffle two grams of the ash of each of the 187 samples of cactus analyzed.

TABLE I.—*Chemical analyses of representative samples of cacti.*

Number of sample.	Scientific name of cactus.	Locality.	Date of collection.	Formula.[a]	Total ash in air-dry plant.	Carbon.	Sand.
					P. ct.	*P. ct.*	*P. ct.*
6255	Opuntia fulgida	Santa Catalina Mountains, Ariz.	May 4, 1904	(6-6)	14.25	.74	1.65
6331	Echinocereus enneacanthus	Eagle Pass, Tex.	May 10, 1904	Plant	17.78	.26	3.31
3000	Opuntia macrocentra	Garfield, N. Mex.	July 11, 1904		16.45	.62	4.27
6699	Cereus giganteus	Tucson, Ariz.	July 28, 1904		15.75	.17	.44
7515	Opuntia lindheimeri	Encinal, Tex.	Jan. 17, 1905	(2-1-1)3	21.05	.14	.29
	Composite					.38	3.17
	Average of all ashes				19.65	.40	2.40

Number of sample.	Scientific name of cactus.	Pure ash.												
		Iron (Fe).	Aluminum (Al).	Manganese (Mn).	Calcium (Ca).	Magnesium (Mg).	Potassium (K).	Sodium (Na).	Silicic acid radical (SiO_3).	Phosphoric acid radical (PO_4).	Sulphuric acid radical (SO_4).	Chlorin (Cl).	Carbonic acid radical (CO_3).	Total.
		P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
6255	Opuntia fulgida	0.21	0.53	0.09	24.31	8.10	11.89	0.00	0.63	2.54	2.00	1.33	42.73	94.36
6331	Echinocereus enneacanthus.	.31	.13	.09	22.66	5.07	16.61	.62	.80	1.20	2.35	2.90	42.63	95.37
3000	Opuntia macrocentra.	.53	.00	.56	24.75	8.25	8.33	1.57	1.56	2.14	1.16	.95	44.80	94.60
6699	Cereus giganteus	.30	.07	.15	31.64	5.78	6.66	.00	.37	.88	4.12	3.32	41.06	94.55
7515	Opuntia lindheimeri.	.20	.00	.49	26.71	2.27	14.22	.35	.43	1.11	1.15	2.15	49.12	98.26
	Composite	.36	.31	.83	28.90	6.85	10.49	.47	1.90	2.70	1.94	2.20	33.76	90.71
	Average of all ashes.	.31	.24	.36	27.38	5.31	9.71	.42	1.58	1.39	1.64	1.84	45.90	95.75

[a] For explanation of formula, see page 6.

FOOD VALUE OF DIFFERENT PARTS OF THE PLANT.

The opinion is prevalent in southern Texas that the old woody stems of *Opuntia lindheimeri* fed there are much more valuable as a stock food than the younger growths. So firmly do many believe this that they practice cutting off and throwing away two or three of the terminal joints when feeding. In Mexico, on the contrary, the young growth is always fed; but there the species are commonly much larger and stouter, and the trunks are altogether too woody to be fed even if it were desirable to do so. The reasons for the opinions current in Texas are rather clearly brought out in the analyses. The younger growth has a relatively higher water content, and therefore probably causes more scouring, which is the only evil influence overcome by a rejection of it. On the other hand, the old stems contain a much larger proportion of fiber and are really of less forage value.

Guthrie,[a] after comparing his own analysis of the stems of four Australian species with the analysis of fruits made by Wolf, concludes that the latter are of less forage value than the stems, because they contain a smaller proportion of nutritious substance and more crude fiber. Forbes,[b] on the other hand, concludes from analyses of Arizona cylindrical-jointed species that the fruits of these species are relished by cattle on account of their high ether extract (including fats). Our analyses show that the ether extract is mainly a constituent of the seeds, and since these pass through cattle undigested can contribute nothing to either the palatability or nutritive value of this part of the plant. That the seed is not digested is plainly shown in the case of *Opuntia lindheimeri* in many favorable seasons in portions of Texas. In the vicinity of Austin, in the early spring of 1904, there were numberless young plants springing up from cattle droppings in many of the pastures. They were fully as numerous in some situations as are the seedlings of the mesquite under similar conditions in favorable seasons in the river valleys of Arizona and on the plains of southern Texas.

This applies to the genus Opuntia, to which belong the prickly pears and cane cacti. The seeds of the other group are very different in character. There is no doubt that burros, which commonly feed upon the fruits of the viznaga (*Echinocactus wislizeni*), get a great deal of nourishment out of the seeds, which are very oily and easily masticated. It is interesting to note that No. 8170a (*Opuntia fulgida*) contains but little more food value in the whole fruit than is found in the pulpy portion alone, but in this sample most of the seeds were poorly developed or sterile. Other samples of fruit of the same species show an apparently greater food value.

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[a] Agricultural Gazette, New South Wales, 11: 671. 1900.

[b] Arizona Agricultural Experiment Station, Annual Report, 15: 496. 1904.

TABLE II.—*Chemical composition of the different parts of fruits of cacti.*

Number of sample.	Scientific name of cactus.	Part of fruit analyzed.	Water.	Ash.	Protein.	Fat.	Nitrogen, freeextract.	Fiber.	Organic matter.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
8022a	Opuntia phaeacantha	Seed..........	7.26	1.75	6.07	11.41	23.18	50.33	90.99
8022b	Opuntia phaeacantha	Pulp..........	92.50	2.09	.20	.07	4.63	.51	5.41
8162a	Opuntia spinosior ...	Whole fruit...	77.74	2.97	1.74	1.11	11.50	4.94	19.29
8162b	Opuntia spinosior...	Pulp..........	83.04	3.10	.55	.24	11.74	1.33	13.86
8173a	Echinocactus wislizeni.	Seed..........	8.59	3.09	10.92	15.46	36.59	25.37	88.31
8173b	Echinocactus wislizeni.	Pulp..........	94.14	.96	.63	.06	3.05	1.16	4.90
8170a	Opuntia fulgida......	Whole fruit...	82.84	2.70	.63	.51	11.63	1.69	14.46
8170b	Opuntia fulgida......	Pulp..........	87.17	1.58	.47	.27	9.66	.91	11.25

It must be undertood that we have analyzed here but few fruits aside from those which are of more value for forage than they are as food for man. None of the cylindrical-jointed species and but few of the native prickly pears of the United States bear edible fruits.

A BALANCED RATION OF PRICKLY PEAR.

To determine in just what proportion cactus should be fed with other foods to produce a balanced ration, it is necessary to know the amount of digestible nutrients contained in the cactus, as well as those of the food or foods with which it is to be fed. This has been determined for most foods, but unfortunately there are as yet no such data for the cacti. It is hoped to be able soon to obtain the coefficient of digestion for *Opuntia lindheimeri*. For the present, all that can be done is to assume this digestibility coefficient to be the same as that of some food as similar in chemical composition and properties to the cacti as possible. It is somewhat difficult to secure a green fodder very similar in character to cactus, but perhaps its digestion coefficient will not be missed very far by assuming it to be the same as that of immature green corn fodder. By using the coefficient for this fodder the nutrients in *Opuntia lindheimeri* are found to be: Protein, 0.47 per cent; fat, 0.26 per cent; carbohydrates, 7.85 per cent. This being the case, cactus would have a nutritive ratio of 1:18, a ratio which according to the best authorities would prohibit its use alone for any feeding standard. The nutritive ratio for a standard ration varies from 1:4 to 1:12, depending upon the age, character, and kind of animal to be fed, as well as the object of the feeding; that is, whether it is desired to produce work, flesh, or milk.

If the object of feeding is to produce milk, a cow giving a heavy yield of milk should, according to the best authorities, be fed about 25 to 30 pounds a day of organic matter, containing from 1.8 to 2 pounds of digestible protein, from 0.4 to 0.7 pound of digestible fat, and 11 to 13 pounds of digestible carbohydrates, making a nutritive tio of from about 1:5.5 to 1:7. If a cow requiring a ration of this nd should eat cactus alone, it would take 160 pounds to furnish the ts and carbohydrates and an additional 240 pounds to furnish fficient protein, and since to avoid scouring a cow should prob- ly not be fed to exceed 50 or 60 pounds of cactus a day, it may be adily seen how impossible it would be for a milk cow to get even a e–sided ration from cactus alone.

A ration of 40 pounds of cactus with 10 pounds of wheat bran and 2 pounds of corn stover would furnish the nutrients in somewhat ear the proper proportion. In a ration of this kind the cow would et 21.16 pounds of organic matter, containing 1.68 pounds of pro- ein, 11.82 pounds of carbohydrates, and 0.49 pound of fat, which is a ratio of 1:7.7.

If a ration is desired in which the cactus is fed with dried brewers' rain and cotton-seed meal, it could be made by feeding 60 pounds of actus with 14 pounds of brewers' grain and 1 pound of cotton-seed eal. In this case 20.58 pounds of organic matter are fed, containing .85 pounds of protein, 10.38 pounds of carbohydrates, and 1 pound of at. This ration would contain the nutrients in the ratio of 1:4.5. If his ration is considered too narrow, it could be widened to good advan- age by feeding with it a small quantity of coarse, dry fodder, rather han by increasing the amount of cactus.

A balanced ration of cotton-seed meal and cactus can not be pre- ared, for if the meal be fed in just sufficient quantity to furnish the roteids it would necessitate the feeding of too much cactus to sup- ly the remainder of the carbohydrates. From this it must not be nferred that a mixture of these foods would not make a desirable ation; in fact, current successful practice has demonstrated that it will. For example, a ration of prickly pear and cotton-seed meal was ed to steers for one hundred and five days in a recent experiment conducted by the Bureau of Plant Industry at Encinal, Tex., with a gain of 1¾ pounds of flesh a day at a cost of only 3⅓ cents. Any ration of these two foods that would secure this gain each day would contain an excess of the proteids over an amount necessary for a balanced ration. Fortunately, however, an excess of proteids can be utilized in serving the function of the carbohydrates in the animal body, and this no doubt is what took place in the above experiment. Usually proteids are the most expensive foods for man and beast, and it is poor economy to substitute them for carbohydrates; yet such a condition is not uncommon in Texas cattle feeding, where cotton-seed meal is cheaper than other more starchy foods.

RELATIVE VALUE OF THE THREE GROUPS OF CACTI.

On account of several practical considerations the prickly pea are of much more value than either of the other two groups. They are more numerous in the wild state, they adapt themselves to cultivation more readily, make a more rapid growth, and are more readi propagated from cuttings, all of which are of vital importance in th economic use and handling of the crop. Practically all of the Mexican prickly pears are fed to stock to a greater or less extent, especially those growing where fodder is the most scarce, but there is only one cylindrical-jointed species (*Opuntia imbricata*) which is used t any appreciable extent. The experience of the writers has shown tha *Cereus giganteus* is readily eaten by cattle when chopped up, b they know of no actual feeding having been conducted with it o any commercial scale. Mr. C. R. Orcutt states that *Echinocactu orcuttii*, which is typical of a considerable group of species, is occasionally fed in Lower California. It is only in rare instances, however, that any great quantity of feed can be secured from cacti, outside of the genus Opuntia, and the greater part of the feed in thi genus is produced by the flat-jointed forms. There are about fiv species in the cylindrical-jointed group which have been fed wit some success. *Opuntia imbricata*, from Mexico, has been referred to, and in various writings the use of *Opuntia arborescens*, *Opuntia spinosior*, and *Opuntia fulgida* are mentioned. To these should be added *Opuntia prolifera* from the coastal region of southern California. These species constitute, without doubt, the best of the cylindrical-jointed group, and when extent of territory covered, succulence, and ease of propagation are taken into consideration *Opuntia fulgida* and *Opuntia imbricata* are probably the most valuable of this group. *Opuntia arborescens* has a decidedly valuable characteristic in that it extends farther to the north than any of the other economic species of any of the groups, and it is fed to a considerable extent in localities from southern Colorado southward.

The use of these species, however, and, in fact, the extended use of nearly all the native species of this country and Mexico, presupposes artificial preparation. In dry seasons in southern Arizona, cattle feed upon the pendent bunches of fruits of the cholla (*Opuntia fulgida*), but it is done at a great sacrifice of comfort. The Texas pear (*Opuntia lindheimeri*) is grazed to a considerable extent by cattle, sheep, and goats without any preparation whatever, and even such thorny forms as cardon, shown in Plate I, are grazed by cattle in extreme cases.[a]

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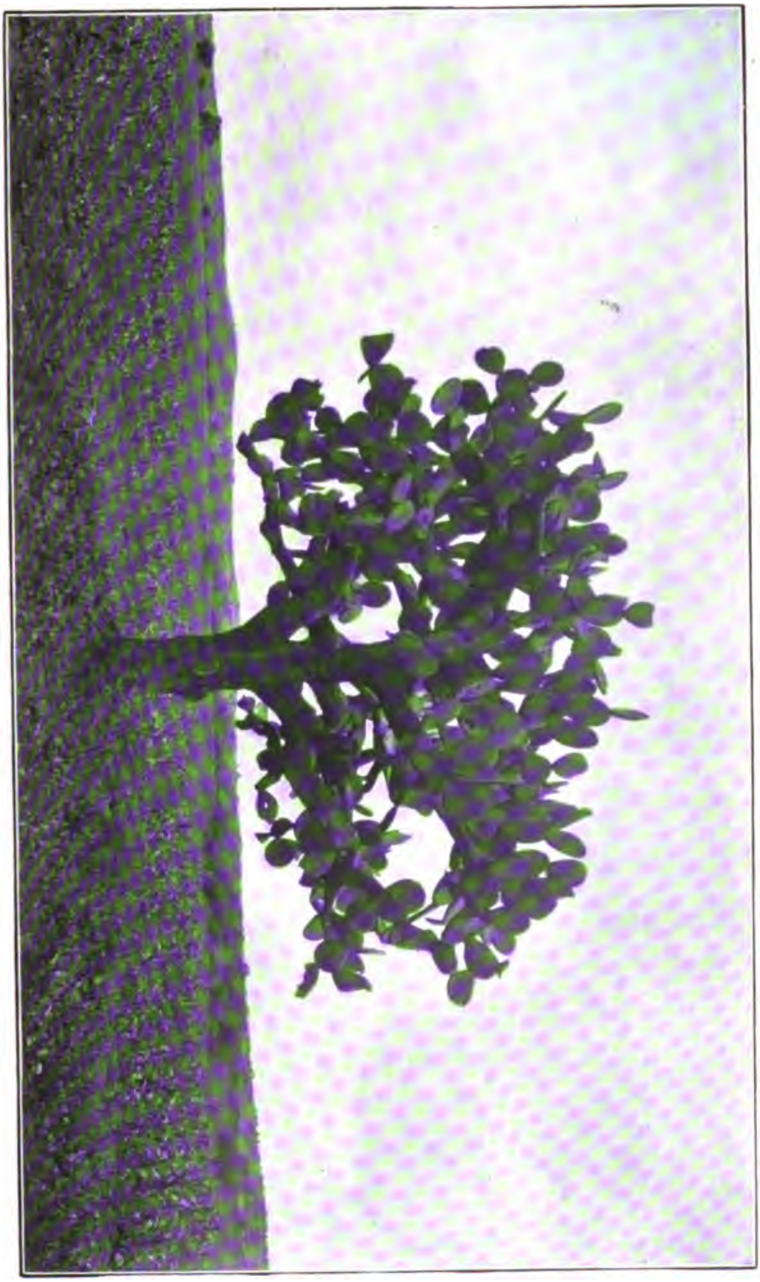
[a] For further discussion, see Bulletin 74 of the Bureau of Plant Industry.

PLATE I.



Nopal Cardon (Opuntia streptacantha Lehm.), the Most Important of the Mexican Prickly Pears.

COMMON AND SCIENTIFIC NAMES.

Considerable attention has been given to the popular names by which the various species are designated, especially the larger Mexican orms, but inasmuch as these are to be more fully considered in nother publication now in process of preparation a full discussion of he subject is postponed.

The chaotic condition of the scientific literature and the general mperfection of knowledge of prickly-pear forms have rendered it very difficult to properly name the species discussed. The purpose of the writers has been to present the exact status of their information, ndicating a doubt wherever one occurs. The Engelmann species, which are largely United States forms, are comparatively easily determined, in most cases through a reference to the types in the herbarium of the Missouri Botanical Garden. In case of long-established species, however, it is absolutely impossible to correlate the specimens with the literature and determine what name belongs to the plant under discussion. *Opuntia tuna*, for instance, has been paraded in literature a great deal, and to it has been assigned all sorts of species; but, as pointed out by Berger and Maiden especially, no one knows what the species is, and the writers know of no way by which its identity can ever be determined.

Some species are referred to their proper genera only. Others are given common names besides, but the majority of them are given scientific names. All species receiving chemical analyses are represented in our collections by specimens mounted upon sheets in the ordinary way or put up in boxes or in liquid. Many are growing in conservatories or upon one of the plantations maintained by the United States Department of Agriculture, while the seeds of many species have been widely distributed to those interested in the scientific and economic study of the group. The work is therefore well supported by specimens to which access will be had in completing in the future such naming as has not hitherto been undertaken. It was early recognized that good dry specimens were absolutely necessary for this work in order to make the chemical analyses and determinations of permanent value.

Whenever a sample or set of samples represents a striking or constant variation it is treated separately in the text; consequently *Opuntia lindheimeri*, for instance, appears several times under two or more headings. Each number or group of numbers is accompanied by a brief set of notes made in the field beside the plant when the samples were collected, elaborated and perfected by subsequent experience. These are presented as field notes simply and not as full technical descriptions. This rather full set of notes, popular and scientific names, and, as a final resort, our specimens and photographs, will make it possible to easily verify the determinations of the writers.

CLIMATIC REQUIREMENTS OF PRICKLY PEARS.

Prickly pears and other cacti are apparently inseparably connect
in the public mind with drought and heat, but this conception of t
requirements for their best development is far from perfect. O
driest deserts produce none of these plants in economic quantiti
and the same is true of our hottest regions. Rather than say th
are adapted to conditions of extreme heat and drought, it should
said that they thrive best in a region which has an equable temper
ture and a considerable rainfall periodically distributed. There
certainly no region in the world where these plants grow naturally
such profusion as they do upon the plateau of Mexico, but this is no
hot country; neither is it excessively dry. It is very dry during
large part of the year. It is a desert as compared with eastern Tex
for instance, but it has a considerable rainfall during an average yea
The rain falls mostly in the summer, and then the country looks li
anything but a desert. The average rainfall at Zacatecas for th
past ten years, as stated by Mr. Albert L. de Lautreppe, who ha
made a special study of the weather records of that city in connectio
with a business venture, is 31½ inches, but the average for the seaso
from January to April and from October to December is only fiv
eighths of an inch to 2⅜ inches, while the average for the other month
of the year is 3½ to 7⅜ inches a month. June, July, and August a
the rainy months, having an average rainfall of 4¼ to 7⅜ inches eac
for the past ten years.

While many species appear to be able to withstand high temper
tures, they develop naturally in the greatest profusion where the hea
is not excessive. The plateau of Mexico is a region with compar
tively equable climate. Some species thrive under extremes
heat. *Opuntia lindheimeri* is at home in the lower Rio Grande Valle
of Texas and Chihuahua, and the closely related *Opuntia engelman*
and *Opuntia engelmanni cycloides* thrive in southern Arizona, whe
the mercury often reaches 111° F. On the other hand, there a
species which grow where the winter temperatures go to at least –40
F., but the plants are small and of no economic importance in them
selves except as they may be used to give a hardy character to mo
valuable species. The valuable species of the Mexican highland
thrive where the temperature falls to 14° F. in very rare instance
Usually the freezing point is only rarely reached here. During th
past winter (1905–6) the mercury dropped at the city of Zacateca
to 14° F., and many of the more delicate spineless forms, as we
as the natives, were badly injured. No pear was killed outright, bu
the branches were frozen down for four or more joints. These rotte
and dropped off, but the old trunks survived. *Opuntia lindheimer*
the common species of southern Texas, has been injured very severel
within the memory of the present generation. It suffered some injur

iring the winter of 1904–5. In the vicinity of San Antonio many the plants drooped badly after the coldest weather, which registred a temperature of 12° F. The majority of the plants straighted up again, but in many the distal joints dropped off as the result freezing.

THE USE OF PRICKLY PEAR IN MEXICO.

In Mexico the use of the prickly pear is much more varied than in is country. There the established plantations are guarded from imal depredations either by rude fences or hedges of some of the ll columnar species of Cereus or the more spiny opuntias. The tter are planted thickly in borders around the more nearly spineless rms, which stock eat readily.

All of the species are fed to stock indiscriminately. Whatever is vailable and can be spared is singed and fed to cattle. So far as bserved, the durasnillo (*Opuntia leucotricha*) is preferred to all others. his is due to some extent to its small fiber content, but more speially to its abundant delicate spines, which are singed off more eadily than those of other species which have fewer spines.

However, the extent of cattle feeding upon this kind of food is ot so great in Mexico as one would suppose from the abundance of he material and the great extent of time during which the practice as been in vogue. The fact is that the average Mexican peon can not fford to feed to stock what he himself can use so profitably in other ays. The prickly pear is to him primarily an article of human ood, and its place can not be taken by any other plant.

The young joints as well are eaten by man in Mexico, and the ried stems and joints are used for fuel. Of course, this fuel is xceedingly poor, but it serves the purpose in that land where this ommodity is exceedingly scarce. The feeding of cacti to stock, herefore, is a secondary consideration. The limbs which break ff and such other portions of the orchard material as can be spared ithout seriously jeopardizing the tuna crop, together with such ild forms as are available, are fed to cattle. On some of the large aciendas, especially those devoted to maguey culture, the feeding f pear to work oxen during the grassless season is a regular practice, but then only wild forms are used. Over a large part of the Repubic, therefore, although the prickly pears are much used for forage, heir principal use is as an article of human food.

THE SPECIES OF CACTI AND THEIR ANALYSES.

In all, 67 species and varieties of cacti are discussed, all of which have been analyzed chemically, some represented by as high as five samples. One hundred and eighty-seven fodder analyses and 26 complete ash analyses have been made. The following brief table will illustrate the characteristic composition of representative samples, together with an average of all the samples.

TABLE III.—*Chemical composition of representative samples of cactus plants and fruits.*

Number of sample.	Common name of cactus.	Scientific name of cactus.	Character of sample analyzed.	Formula.	Green.								Air dry.							
					Spines.	Water.	Ash.	Crude protein.	Crude fat.	Nitrogen-free extract.	Crude fiber.	Organic matter.	Spines.	Water.	Ash.	Crude protein.	Crude fat.	Nitrogen-free extract.	Crude fiber.	Organic matter.
					P.ct.	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*
6329	Nopal, prickly pear.	Opuntia lindheimeri.	Last year's growth mostly.	(5-0-0-0)4	0.76	80.72	4.44	1.38	0.42	10.87	2.17	14.84	3.73	5.33	21.78	6.79	2.08	53.37	10.65	72.89
7571	do	do	Terminal joints	(4-0-0-0)3	Few.	88.64	1.64	.55	.29	7.72	1.16	9.72	Few.	7.03	13.40	4.49	2.40	63.15	9.53	79.57
6330	do	do	From old stems		.58	77.95	5.81	.92	.41	11.58	3.33	16.24	2.51	5.14	25.00	3.94	1.78	49.81	14.33	69.86
7572	do	do	do	(0-0-0-0-1-1-1)3.	Few.	84.49	2.42	.36	.27	8.80	3.65	13.08	Few.	6.35	14.60	2.19	1.65	53.18	22.03	79.05
6542	do	do	Early-maturing fruits.		Few.	92.19	1.09	.65	.49	2.85	2.73	6.72	Few.	4.85	13.23	7.88	5.95	34.89	33.20	81.92
6530	Nopal tapon	Opuntia robusta.	Joints 1-3 years old.	(2-2-1)5	.71	89.62	2.95	.63	.23	4.81	1.76	7.43	6.43	5.68	26.81	5.70	2.13	43.70	15.98	67.51
7590	do	do	Joints 1-5 years old.	(1-0-1-0-1)3	.25	89.62	1.93	.46	.18	5.98	1.83	8.45	2.33	4.55	17.79	4.27	1.64	54.95	16.80	77.66
6529	do	do	Partly mature fruit.		Few.	88.59	1.29	1.06	1.13	3.84	4.09	10.12	Few.	5.41	10.70	8.76	9.38	31.80	33.95	83.89
6531	do	do	Mature fruit		Few.	96.81	.26	.23	.23	1.80	.67	2.93	Few.	6.38	7.65	6.79	6.76	52.72	19.70	85.97
6254	Cholla	Opuntia fulgida.	Joints 3-4 years old.	(0-0-6-1)	1.78	72.63	3.88	.95	.43	20.39	1.72	23.49	6.13	5.60	13.40	3.29	1.48	70.27	5.96	81.00
6255	do	do	Joints 1-2 years old.	(6-6)	2.27	78.03	3.36	1.30	.35	15.37	1.59	18.61	9.60	6.95	14.25	5.48	1.48	65.09	6.75	78.80
7802	do	do	Joints 4-6 years old.	(2-3-2)7	1.72	81.51	2.21	.96	.28	14.21	.83	16.28	8.64	7.10	11.10	4.82	1.41	71.41	4.16	81.80
7796	do	do	do	(0-0-0-1-2-1)3	.94	70.33	2.73	.95	.43	17.99	7.56	26.94	2.96	6.19	8.63	3.00	1.36	56.92	23.90	85.18
6253	do	do	Fruit		Few.	83.48	2.79	.59	.36	11.18	1.60	13.73	Few.	4.88	16.05	3.39	2.09	64.36	9.23	79.07
7801	do	do	Fruit 1-6 years old		Few.	80.29	3.25	.56	.47	13.77	1.66	16.46	Few.	5.43	15.60	2.70	2.24	66.05	7.98	78.97
8170a	do	do	Fruit, largely sterile		Few.	82.84	2.70	.63	.51	11.63	1.69	14.46	Few.	5.16	14.99	3.50	2.85	64.12	9.38	79.85
8170b	do	do	Fruit, largely without seed		Few.	87.17	1.58	.47	.27	9.60	.91	11.25	Few.	4.55	11.73	3.50	1.98	71.49	6.75	83.72
6561	Sewarah	Cereus giganteus	Mature fruit		Few.	91.62	.98	1.05	.61	3.64	2.10	7.40	Few.	5.88	11.05	11.83	6.86	40.73	23.65	83.07
6699	do	do	4 sections of stem		.92	87.31	2.20	.81	.17	8.07	1.44	10.49	6.63	8.98	15.75	5.80	1.20	57.92	10.35	75.27
7805	do	do	3 sections of stem		.28	92.36	1.30	.67	.16	4.45	1.06	6.34	3.41	5.80	15.98	8.28	1.94	54.95	13.05	78.22
Average of all prickly pears analyzed					.44	84.26	3.06	.73	.34	9.04	2.41	12.53	2.53	5.89	18.25	4.61	2.24	54.26	14.77	75.86
Average of all cane cacti analyzed					.79	78.47	3.61	1.41	.63	12.30	3.59	17.93	3.32	6.15	15.50	6.09	2.77	54.32	15.17	78.35
Average of all miscellaneous group analyzed					1.03	87.88	1.67	1.05	.41	7.22	1.76	10.45	8.62	6.53	13.54	8.49	2.[illegible]	54.96	13.63	79.93

. P. I.—243.

A SUCCESSFUL DAIRY FARM.[a]

By L. G. DODGE, *Scientific Assistant, Farm Management Investigations.*

INTRODUCTION.

In Delaware County, N. Y., is a farm of 200 acres, owned by John T. McDonald and managed by him as a dairy farm. About half of the and is meadow and half is permanent pasture. A small portion of the meadow is each year plowed up for other crops—a few acres of corn for soiling and a few acres of peas and oats for hay. This farm lies in the valley of a tributary of the Delaware River and extends up the hills on either side, so that the tillage land is gently rolling, while the pasture is comparatively steep. The soil is a reddish brown loam, originally filled with fragments of shale rock. The dwelling house, barn, and dairy are located on the highway at a little distance from the creek, and the mill and tenant houses near the road crossing the creek. (Pl. I, fig. 1.) The water supply is abundant, coming from several springs nearly 100 feet higher than the buildings. The shipping point is 5½ miles distant, over an easy road.

The dwelling house of the owner is provided with good plumbing, is well heated, and is lighted by electricity. The barn contains 124 cow stalls on the main floor and has a manure cellar below. The second floor can be driven upon also, and has six horse stalls and a grain room, while most of the remainder is used as a hay loft. The dairy building adjoins the barn and is equipped with steam power and the necessary machinery for butter making. A small mill for sawing and planing and for grinding grain is run by water power from the brook. In this building is a small dynamo, also run by water power, which furnishes light for all the buildings, including the cow and horse stables, the dairy building, and the three small houses for the farm hands, as well as the owner's residence. There are also a small tool shed and hay barn near the large barn and a tool shed near the mill.

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[a] This article is one of a series issued by the Bureau of Plant Industry giving the results of the study of systems of management on successful farms of various types. The cropping system on the farm here described is unique, in that half the land is in permanent pasture and half in nearly permanent meadow. Each year a few acres of the meadow that seem most to need resetting are broken up, sown to peas and oats with which grasses and clovers are seeded, or planted to corn for soiling, this to be followed by peas and oats with grasses and clovers. The special lesson to be learned from this farmer's practice is the method of managing permanent grass land to maintain its productivity.—W. J. SPILLMAN, *Agriculturist in Charge of Farm Management Investigations.*

The farm supports about 100 head of milch cows, 25 head of young stock, 600 hens, 5 horses, and 3 or 4 hogs. Eight hired men are employed the year round. More cows are in milk in winter than in summer and the extra work in the dairy compensates for the decreased field work in winter.

The equipment of implements, tools, machinery, etc., is as follows: Two plows of the swivel type (hillside plows); 2 harrows; 1 manure spreader; 1 grain drill; 1 6-foot mower; 2 hay rakes (1 one-horse, 1 two-horse); 1 tedder (one or two horse); 2 wagons, with hay racks and brake; 1 express wagon; 1 set of ice tools; dairy equipment; saw and grist mill equipment; dynamo and lights; 1 incubator.

The land is not divided by fences into small lots, but is inclosed entirely by a stone wall, which was built when clearing the land of stone, for all the land was formerly as stony as the pastures now are. (See Pl. I, fig. 2.) Some of the tillage land has been drained with stone underdrains, and from a good deal of it there has been a great number of old pine stumps pulled out.

THE ROTATION FOLLOWED.

The rotation on this farm, if such it may be called, is exceedingly simple. Broadly speaking, half the land is in permanent pasture and half in meadow. Most of the 100 acres of meadow land is in grass and clover. Each year about 12 to 15 acres of this grass that seem most to need renewing are broken up. Of this, 2 or 3 acres are devoted to corn for green feed in late summer, to be followed by peas and oats the next spring. The remaining 10 to 12 acres are sown at once to peas and oats for hay. In each of these cases grass and clover are sown with the peas and oats, the land thus being returned to semipermanent meadow. If the seeding fails, it is repeated after the peas and oats are cut for hay. This gives a long period during which the land stays in grass, but owing to the fact that the owner spreads the manure from more than a hundred head of live stock upon this land, hauling it at nearly all seasons of the year, midwinter and haying time excepted, the fields are kept in such a productive condition as to cut an average of 2 tons of hay per acre over the entire meadow area, including the peas and oats.

As soon as the ground is hard enough to drive over in the spring, the manure is brushed with a brush harrow, the man who drives the harrow sowing at the same time a very light application of clover seed—so light, in fact, that 1 bushel of red clover and 1 bushel of alsike mixed go over the greater part of the 100 acres. Or, when manure is being spread in the spring, some clover seed is applied by sprinkling about a cupful on top of the loaded manure spreader. This plan

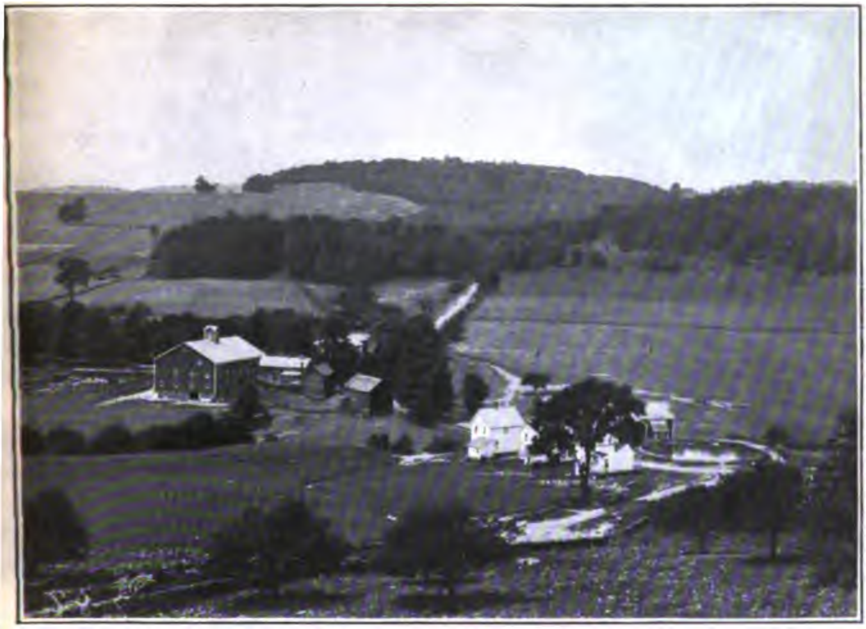

FIG. 1.—VIEW ACROSS THE LOWER END OF THE McDONALD FARM, SHOWING THE BUILDINGS, THE DWELLING HOUSE BEING PARTIALLY CONCEALED IN THE TREES.

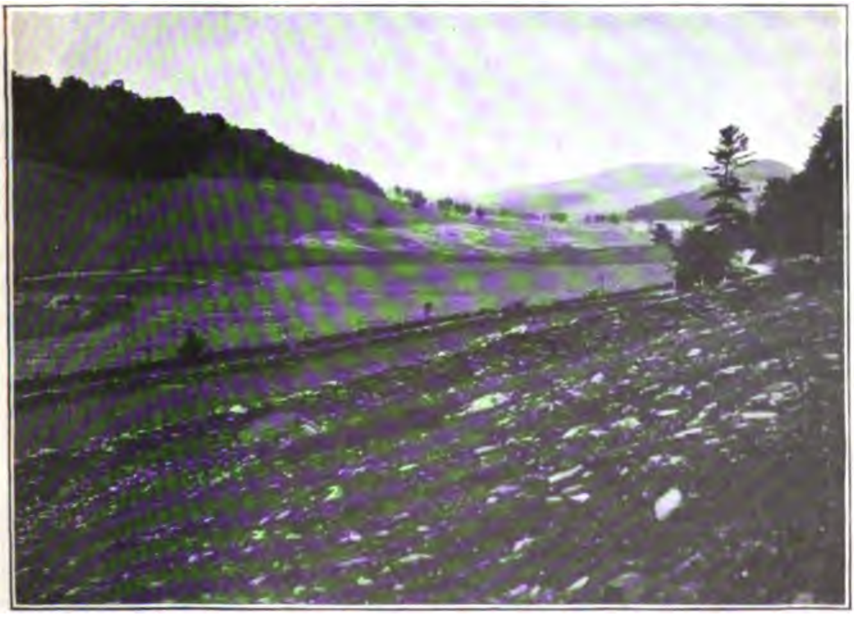

FIG. 2.—VIEW ACROSS THE UPPER END OF THE FARM, SHOWING THE STONY NATURE OF THE LAND IN THE PASTURE, THE PRESENT CONDITION OF THE HAY LAND, AND THE LOCATION OF THE MILL POND.

provides for renewal of the clover and, through the agency of the clover and manure, maintains a better condition of the other grasses. The owner believes also that the seedling plants of the clover hold better through an unfavorable winter in the sod than they would in a newly fitted seed bed. The manure is applied, so far as possible, with a spreader.

Oats and peas are seeded at the rate of 2 bushels of oats and 1 of peas per acre; with these 6 quarts each of timothy and clover per acre are sown, the drill with which the grain is sown being provided with a grass-seed attachment. Then if the oats lodge or the season is unfavorable, so that the grass is killed out, a new application of seed is made as soon as the oats and peas are cut, and the seed worked in with a brush harrow. Following this a light coating of manure is put on with the spreader. If the field should come in full of weeds it would be replowed before seeding, but in any case the owner's plan is to get a stand of grass as soon as possible, that being his best crop.

HARVESTING THE HAY.

Since hay is the principal crop on this farm, it is worth while to consider the method employed in putting in the hay and the utilization of labor at that work. On the first day of hay harvest one man runs the mower in the forenoon; another man runs the tedder in the forenoon and the rake in the afternoon. Late in the afternoon one or more men begin cocking the raked hay.

In the forenoon of the second and later days one man with a team runs the mower, another the tedder, and four men spread out the hay cocked the previous afternoon in order that it may dry. In the afternoons two men and teams haul hay from the field to the barn. The proprietor works the hay fork on the loaded wagon, two men distribute the hay in the mow, two pitch hay in the field, one rakes the hay cut and tedded in the forenoon, and another cocks the raked hay. The man last mentioned also finds time to feed the hens in the afternoon.

One of the hands spends his whole time in the dairy. Another man is engaged in the dairy in the forenoons for a local dairy company whose milk is handled in Mr. McDonald's building, while in the afternoons this man works for Mr. McDonald in the hayfields or wherever needed. Consequently in the forenoons there are eight men besides the proprietor at work, and in the afternoons nine men are working on the farm.

During forenoons in hay harvest the proprietor spends his time grinding sickles and in superintending the work of his men so as to keep them all profitably employed.

From 5 to 6 o'clock in the afternoon most of the men are kept busy milking. Those who handle the work teams, however, have their teams to care for, and, during hay harvest, one of these is back in the field shortly after 5.30 and both wagons are loaded and drawn in before 6.15 o'clock. The lighter team is hitched to the two-horse rake at 6 o'clock and rakes until 7.30. The men who milk, after getting their supper go to the field for a short time to bunch up hay or load the two wagons. This makes a long day for the men, but this extra labor is required for only a short time in the busy part of the haying season; at other seasons the normal day's work ends at 6 o'clock.

Two days in the week the butter and eggs must be delivered to the station, so instead of both teams going into the field on these days one man with the lighter team starts about 7.30 o'clock a. m. for town, returning before noon. On the day that the writer watched operations closely the other team began drawing hay shortly after 8 o'clock and had in two loads by 10.30. Of twelve loads brought in during the writer's visit, two were weighed. One had 2,400 pounds of hay on it, the other 2,900. It is reasonably certain that the average was at least 2,500 pounds and all were taken off an area of not more than 5 acres, most of which had not been plowed for fifteen years. This shows a yield of approximately 3 tons to the acre and was made up wholly of fine grasses with clover mixed in, a most excellent quality of dairy feed. The teams which do this work are of good size. One pair of mares weighs 2,700 pounds, the other pair, horses, 2,860 pounds. The single rake was drawn during the afternoon by the driving horse, considerably lighter in weight.

As soon after haying as there is sufficient aftermath to furnish feed the cows are turned into the meadows, for the permanent pasture is then getting dry. Any newly seeded piece, however, is previously given a light coat of manure, which prevents the cows from grazing it down, and any other piece which would be hurt by grazing is treated likewise. The cornfield is shut off with a temporary wire fence. Some manure is spread occasionally even on the permanent pasture.

FEED FOR THE COWS AND CALVES.

As soon as the pasture gets dry and insufficient in the summer, and before the mowing land can be used, a suitable quantity of hay is fed to the cows every day, and later on the corn is fed out green. The roughage for winter feed is entirely of this mixed hay, which contains a large proportion of clover. The cows get, when in full milk, 8 pounds of grain a day, in two feeds. The grain is mixed, consisting of 1 part cotton seed meal, 2 parts ground corn, 2 parts ground oats, and 4 parts wheat bran. Skim milk is fed to the calves until they are more than a year old, and the surplus at all times is given to the milch cows.

BUTTER PRODUCTION.

The cows freshen during the fall, so that most of the butter is produced in the winter; fresh pasture comes on at such a time in the period of lactation as to prolong the flow of milk in the spring. The cows produce on an average a pound of butter each per day for three hundred days in the year—that is, 30,000 pounds of butter from 100 cows in the course of a year. The butter is sold as soon as made the year round to regular customers, mainly in New York City. The selling price is 35 cents, Mr. McDonald paying the express charges to the city. By the use of plenty of hay and skim milk for the calves as they grow up they are kept in vigorous shape and breed rather earlier than the average, so that many of the heifers are in milk at two years of age.

POULTRY PRODUCTION.

Four hundred of the 600 hens kept on the farm are housed in one long, cheaply constructed house. This house is divided so that approximately 50 hens are in each inclosure. The other 200 hens for breeding stock are kept in smaller pens in a separate location.

RESULTS ACHIEVED.

The gross receipts for a year for butter, eggs, and poultry, with occasionally a small quantity of hay sold, amount to $10,000 in round numbers. The annual expenses for grain are approximately $3,000; for labor, another $3,000. The debt on this farm in 1875 is said to have been $8,400, and to have been entirely cleared up in the twelve years following that date. The hay land has been cleared of stumps and stones, the buildings improved and added to (the dwelling house, barn, and dairy now having slate roofs), the mill and electric-light equipment have been put in, and the land rendered vastly more productive than it was in 1875.

The orchard back of the house has been made more productive by general care, and especially by burying on the up-hill side of an apple tree any animal which died on the farm.

In spite of the simplicity of its cropping system, this farm has been rendered so productive as to provide many of the comforts and conveniences usually attributed to city life, and to maintain a large family at the same time.

B. P. I.—245.

PLANNING A CROPPING SYSTEM.

By W. J. Spillman, *Agriculturist in Charge of Farm Management Investigations.*

INTRODUCTION.

One of the lines of work undertaken by the Office of Farm Management Investigations is the making of working plans for farms. Some of these plans are more or less general in character, representing systems adapted to particular types of farms in definite soil and climatic areas. Others are made for individual farms.

There are two principal reasons why work of this kind is undertaken. In the first place, very few farms have any definite cropping system, and it is comparatively easy to plan a system that will meet the requirements of the case and increase the farmer's income. We are thus able to render material service to a considerable number of farmers, whose farms in consequence become centers of local interest and serve as object lessons to the community. In the second place, the number of farms on which the full possibilities of a given type of farming are realized is exceedingly small; so small, in fact, that it is necessary to increase the number very materially before many important problems relating to farm management can be solved.

To illustrate: On the farm of Mr. W. H. Rowe, described in Farmers' Bulletin No. 272,[a] the possibilities of a given system of managing swine with a particular cropping system have been worked out. One litter of pigs a year is produced. These are pastured on clover in summer and fed sufficient grain to bring them to a weight of from 100 to 125 pounds by the end of the pasture season. In winter they are fed grain and soy bean hay. The next summer they return to the clover pasture, while the feeding of grain continues. About the 1st of August they are sold, weighing from 325 to 350 pounds each. This system utilizes the full possibilities of the clover pasture. The extra hogs during early summer consume the abundant growth of clover at that season, while the smaller number later find just about the amount of pasture they can utilize. With this system the farmer is able to sell an average of six large hogs a year for each acre in clover on the farm. This farm is in the North, where winter pasture is not available. The owner knew just what acreage of each crop to grow, and he knew approximately the quantity of grain and mill feed he would need during the year. This is the only instance thus far found in which a farm devoted to hog raising had its problems so fully worked out.

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[a] A Successful Hog and Seed-Corn Farm, 1906.

Suppose, now, a hog farm is located far enough south to make winter pasture available, and that it is desired to produce 200-pound hogs. Fall litters of pigs may be given pasture and grain during winter and early summer, the grain being so apportioned as to cause the hogs to reach the desired weight, say, by the 1st of July. Spring litters may be given pasture and grain till autumn, and then penned and forced rapidly to a weight of 200 pounds. In such a system, on a farm of a given size, what acreage of winter pasture and of summer pasture should be provided? What pasture crops should be used? How much grain should be fed? These are questions that can only be answered by experience. We are able to make estimates that will serve as approximate answers, but the experience of a considerable number of farms is necessary before these estimates can be relied on.

There are similar questions that need to be worked out in connection with nearly every type of farming for every section of the United States. One of the most important reasons why detailed plans are drawn in this office for individual farms is, therefore, to enable us to find valuable material for the study of the possibilities of the various types of farming. Among a large number of plans furnished, some will result in the development of farms to their full possibilities. Every such farm is an object lesson of great value. A large number of such farms would furnish data for generalizations of inestimable value.

The number of distinct types of farming is large, and most farms combine two or more of these types. Even farms of exactly the same type—as, for instance, dairy farms that grow only roughage and buy all the concentrates—may and do have widely different cropping systems. This is true even on contiguous farms of the same type. This field of research is therefore a wide one. It relates in a most vital way to the development of the agricultural resources of the country. If properly pursued it can not fail to result in the accumulation of a vast number of important facts and principles which can be put into pedagogical form and thus become an important subject of instruction in schools.

In attempting to plan a cropping system to fit exactly the needs of a farm, the objection may be raised that this is impossible because of the great seasonal variation in yields. This objection overlooks the fact that every farmer in the United States is actually compelled to make such plans every year, whether they are feasible or not. There can be no two answers to the question whether we shall attempt to aid the farmer in this the most important work he has to do. If agricultural science is of any value at all it must aid the farmer in planning his work. With sufficient study, the ordinary fluctuations in yields become known quantities, and allowances can be made for them. When a farm is heavily stocked, it will occasionally occur that feed will run short. In such cases the only resource is to buy, unless the farmer is willing to dispense with a portion of his stock. It should be remembered that when a farmer is buying feed he is also buying fertility. One of the most successful farmers in this country says: "I usually keep enough stock to eat all I raise, and I usually take the chance of keeping a little more; for it does the farm no harm to buy a little feed if it is needed."

FARM SELECTED TO ILLUSTRATE THE METHODS USED IN PLANNING A CROPPING SYSTEM.

The plan selected to illustrate the methods used in arranging a cropping system to fit definite conditions is one recently drawn for a farm in northern Illinois. The manager had already determined approximately the possibilities of this farm under the particular type of farming he desired to follow. The number of conditions to be met was unusually large. Figure 1 shows the arrangement of the farm as it was presented to us. It will be seen that the arable land aggregates 103 acres. This is all good land, sloping in a fairly uniform manner to the south and west, sufficiently for drainage purposes. It was desired to keep about 25 cows, 5 to 15 head of horses (some of these to be kept for city owners), 50 to 60 hogs, and 100 hens. It was desired that a farmstead be reserved in the northwest corner of the arable portion.

It was preferred that all the stock should be provided with pasture. At the outset it was plain that ordinary permanent pastures for all this stock would occupy too much land. It was therefore decided to provide more productive temporary pastures. The condition of the land justified the assumption of the following yields: Silage, 9 tons; hay, 2 tons; soiling corn, 7 tons. It was assumed that by feeding 5 pounds of hay or 20 pounds of soiling corn per head daily, the pasture could be made to carry 1 cow per acre.

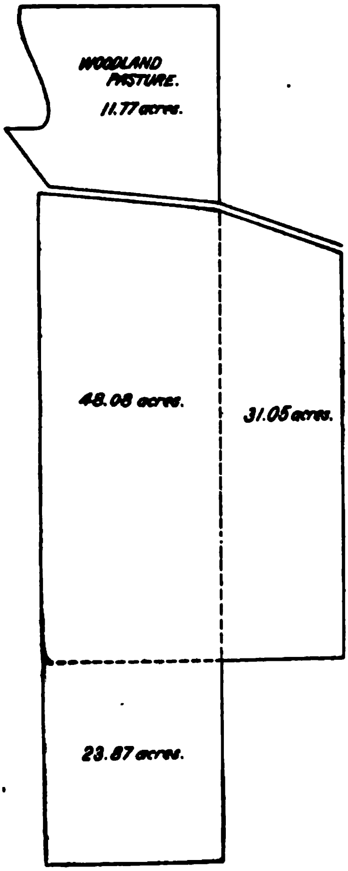

FIG. 1.—Plan of farm as submitted by the manager for the recommendation of a suitable cropping system.

In order to ascertain the quantity of feed required annually, the following system of feeding was assumed:

Cows.

May 10–October 10.—One acre of pasture per head. (This pasture will be second-year timothy and clover meadow.)

May 10–August 10.—Five pounds of hay, with pasture.

August 10–October 10.—Twenty pounds daily of soiling corn or silage with pasture.

October 10–May 10.—The average ration for dry and other cows is silage, 40 pounds; hay, 10 pounds; grain, 4 pounds.

Bulls.

May 10–August 10.—Silage, 25 pounds; hay, 15 pounds; grain, 4 pounds.

August 10–October 10.—Soiling crops, 25 pounds; hay, 15 pounds; grain, 4 pounds.

October 10–May 10.—Silage, 30 pounds; hay, 18 pounds; grain, 4 pounds.

Yearlings.

May 1–October 1.—Pasture, with 5 pounds of hay daily.

October 1–31.—Pasture, with 25 pounds of rape daily.

November 1–30.—Hay, 12 pounds, and rape, 30 pounds, daily.

December 1–April 30.—Hay, 10 pounds, and silage, 25 pounds, daily.

Calves.

First four months, an average of 15 pounds of milk, 5 pounds of hay, and 1 pound of grain daily. (This is a liberal allowance.) Five months, pasture, with 5 pounds of hay daily. One month, pasture, with 10 pounds of rape daily. Two months, hay, 9 pounds, and silage, 15 pounds, daily.

Horses.

An average of 18 pounds of hay and 6 pounds of grain daily throughout the year. This is an overestimate, since some of the horses will be at pasture part of the time, but the number of horses in winter will exceed the number in summer. Besides, it is well to have a reserve of feed in case of short crops.

Hogs.

The system of feeding hogs was assumed to be that used on the farm described in Farmers' Bulletin No. 272, already referred to. These two farms are in the same section and on soil of the same type. The Rowe system was also used, because it is the only one for which accurate data are at hand and which is adapted to the section in question.

The following table gives the number of stock and the quantity of each kind of food required, together with the yields per acre and the number of acres of each class of crops:

Number of live stock.	Silage.	Hay.	Soiling.	Grain.	Rape.	Pasture.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Acres.*	*Acres.*
25 cows	107	34	15	10.7		25
2 bulls	9	6	2	1.46		
10 horses		33		10.95		10
13 young stock	15	15		.39	0.52	
6 sows		2		35.40		5
48 pigs						
Total	131	90	17	58.90	.52	40
Yield to the acre	9	2	7			
Acres	14.6	45	2.43		.52	40

From the preceding table it is seen that the following acreages are required: Corn, 14.6+2.43=17.03; hay, 45; pasture, 40; and rape, 0.52; a total of 102.55 acres. The problem now is to arrange these acreages into suitable rotations.

The fact that the cows need 25 acres of pasture suggests one rotation on fields of 25 acres each. A part of one of these fields may also furnish pasture for the horses. The further fact that the hogs require 5 acres of clover pasture suggests another rotation on 5-acre fields. Since the necessary acreage is practically the whole of the arable land it will be necessary to double-crop a few acres in order to secure space for the farmstead. No estimate of pasture for young stock is included in the table. Since it is desirable to keep about half as many of these as there are mature cows, in order to maintain a high degree of efficiency in the herd, it happens that the tract of 11.77 acres of woodland pasture north of the road just about suffices for the young stock.

THE ROTATIONS ADOPTED.

A careful consideration of the conditions specified and of the many different possible rotations led to the adoption of one three-year rotation as follows: First year, 7 acres of corn and 18 acres of peas and oats; second year, timothy and clover; third year, timothy and clover.

This rotation requires that timothy and clover be sown in the 7 acres of corn at the last cultivation, a common practice in New England and a successful practice on several farms in Iowa, Missouri, and other Western States. Timothy and clover are also to be sown either with the peas and oats, or immediately after the latter are harvested for hay. The third year of this rotation furnishes the necessary pasture for the cows; the second year furnishes the required 10 acres of pasture for the horses and 15 acres for hay. This will require a temporary fence, which, however, is entirely feasible.

In case the seeding of grass fails, rye may be sown after the corn in the fall, to be followed by soy beans for hay the next summer. If the seeding of grass after the peas and oats fails, winter wheat should be sown on the land needed for horse pasture. This will furnish good pasture throughout the summer, as the wheat will not stool until late in the fall or early the next spring. The remainder of the pea and oat land may very properly be planted to sorghum for hay. The next year the whole 25 acres may be sown in winter wheat in the spring, to be used by the cows for pasture during the summer.

To secure the 5 acres of clover for the hogs, in a rotation in which the remaining crops are useful, the following three-year rotation was arranged: First year, corn, in which clover is sown at the last cultivation; second year, clover; third year, peas and oats for hay, followed by rape sown in midsummer.

This rotation permits more rape to be grown than is strictly needed, but the extra quantity can be utilized by the pigs and calves.

If the seeding of clover in the corn fails, sow winter wheat in half of it in the autumn. Pasture this wheat down the next spring, and follow it by sorghum for hog pasture, turning the hogs in on the sorghum when it is about 18 inches high. The other half of the land should be planted to winter wheat in the spring. This will furnish good pasture for hogs throughout the summer.

These two rotations occupy 90 acres of land, and furnish 12 acres of corn, 38 acres of hay, 5 acres of rape, and all the pasture needed. There are still needed 5 acres of corn and 7 acres of hay. Reserving 3 acres for the farmstead, 10 acres on which to grow these crops are left. The evident solution of this problem lies in a two-field rotation of corn, 5 acres, followed by a double crop of hay the next year. Fortunately, the farm described in Farmers' Bulletin No. 272 has shown that soy beans are not only an excellent hay crop in that section, but that they may be planted as late as the last week in June. This fact suggests rye as a winter hay crop. Only 2 acres of this need be used for hay, since only 7 acres of hay are needed and the soy beans furnish 5 acres. The remaining 3 acres of rye will be convenient for bedding. Accordingly, the following two-year rotation was laid out for two 5-acre fields: First year, corn, followed by fall-sown rye; second year, rye, followed by soy beans.

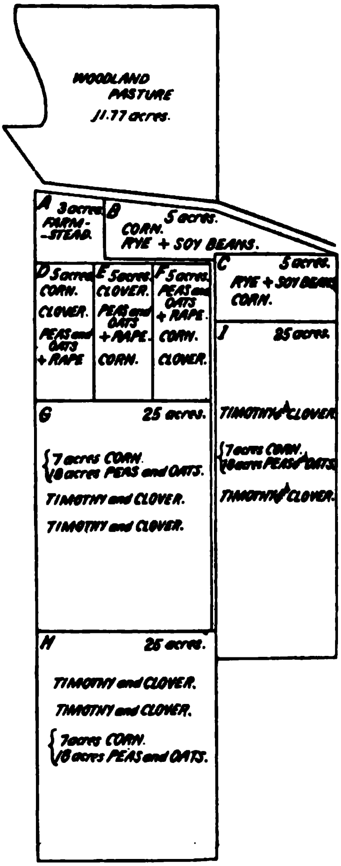
WOODLAND PASTURE
11.77 acres.
A 3 acres FARM-STEAD.
B 5 acres. CORN. RYE + SOY BEANS.
C 5 acres. RYE + SOY BEANS CORN.
D 5 acres CORN. CLOVER. PEAS and OATS + RAPE
E 5 acres. CLOVER. PEAS and OATS + RAPE. CORN.
F 5 acres. PEAS and OATS + RAPE. CORN. CLOVER.
G 25 acres.
{7 acres CORN. 18 acres PEAS and OATS.
TIMOTHY and CLOVER.
TIMOTHY and CLOVER.
H 25 acres.
TIMOTHY and CLOVER.
TIMOTHY and CLOVER.
{7 acres CORN. 18 acres PEAS and OATS.
I 25 acres.
TIMOTHY and CLOVER.
{7 acres CORN. 18 acres PEAS and OATS.
TIMOTHY and CLOVER.

FIG. 2.—Final arrangement of the several fields, showing the cropping system recommended.

It now remains to fit these three rotations into the arable land. Figure 2 shows the final result. This arrangement permits a single road to reach every field on the farm. The peculiar outline of the farm makes this road rather long, but it would be hard to avoid this slight difficulty.

Fields G, H, and I, figure 2, are to be devoted to the three-year rotation consisting of 7 acres of corn and 18 acres of peas and oats the first year, followed by timothy and clover left down two years. The other three-year rotation on 5-acre fields may be run on any three of the fields B, C, D, E, and F, with the two-year rotation on the remaining two. The farmstead occupies the 3 acres in subdivision A. This gives room for a tenant house, barn, chicken house, and a small garden.

On receiving the above plans, the manager of this farm wrote: "I have carefully read your suggestions as to the field arrangements of the farm and the plan of operation. I do not see why I can not carry out every suggestion to the letter."

The results of the operation of this plan will be carefully studied by this office. It will be seen that some features of the plan are somewhat experimental, at least for that locality. Other features are based on successful practice on near-by farms.

ARRANGEMENT OF CROPPING SYSTEMS FOR FARMS.

It is hoped that ultimately it will be possible by the study of farm practice on the best farms to arrange rotations in all parts of the country based entirely on successful local practice. While this office can not undertake to furnish detailed plans for an indefinite number of individual farms, at the same time we desire the opportunity to do a considerable amount of this work, in order that we may test the possibilities of certain types of farming and enlarge the number of highly successful farms, so that we may have more material for the study of farm management. Ultimately it is hoped to formulate generalized plans for farms of various types in all sections of the country, and to make these plans available in our publications.

B. P. I.—246.

THE APPLICATION OF VEGETATIVE PROPAGATION TO LEGUMINOUS FORAGE PLANTS.[a]

By J. M. Westgate, *Assistant Agrostologist in Charge of Alfalfa and Clover Introduction, Forage Crop Investigations,* and George W. Oliver, *Plant Propagator, Seed and Plant Introduction Investigations.*

INTRODUCTION.

The practical difficulties which have presented themselves in connection with the development of improved strains of perennial forage plants have been such as to retard the progress of the work. The necessity for isolation to prevent promiscuous pollination and the time required to secure any considerable quantity of seed have together served to handicap seriously the work of developing new strains of forage plants, especially the perennial legumes. The method of propagating forage plants by means of cuttings herein described has been worked out chiefly in connection with *Medicago sativa* and *Trifolium pratense,* but preliminary experiments indicate that it may be quite as successfully adapted to all dicotyledonous forage plants. Among the species which have been successfully propagated in this manner may be mentioned *Medicago sativa, Melilotus officinalis, M. alba, Trifolium pratense,* and *T. repens.* By using the offsets or innovations the method is also applicable to grasses.

A number of problems in connection with the self-sterility of the different species in question demand further attention. It is hoped that the method here suggested will stimulate the work of developing varieties of forage crops throughout the country.

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[a] In the summer of 1903 a plot of Peruvian alfalfa (S. P. I. No. 9303) in the grass garden of the Department of Agriculture proved resistant to the leaf-spot disease (*Pseudopeziza medicaginis*), which nearly ruined the check plot of ordinary alfalfa. Although this strain is nonhardy and ordinarily winterkills except in the southern portions of the United States, there were two plants which survived the severe winter of 1903–4 in Washington, D. C. These points, together with the hairiness, leafiness, and vigorous growth of this variety, brought it to the attention of those interested in breeding alfalfa. These plants were placed in large pots and moved to the greenhouse to be utilized in the hybridization work inaugurated by Dr. B. T. Galloway. Later on Doctor Galloway conceived the idea of raising a large number of plants of these two individuals vegetatively, in order to produce a large quantity of seeds the same season. This was successfully accomplished by the method here described. The adaptation of this method to the breeding of forage crops, especially the legumes, has proved so promising that it is deemed advisable to publish the results obtained.—C. V. Piper, *Agrostologist in Charge of Forage Crop Investigations.*

DESCRIPTION OF THE METHOD EMPLOYED IN THE VEGETATIVE PROPAGATION OF LEGUMINOUS PLANTS.

The method, as here described, applies specifically to alfalfa. Slight modifications may be necessary in case of its application to other species.

The cuttings should be made about three inches in length, preferably from the upper portion of reasonably matured stems. Plants grown outside the greenhouse produce the best cuttings, but in case the stock plants are not near at hand it is generally advisable to transplant them to the greenhouse, cutting the stems back close to the ground. Such plants will give an abundance of good material for cuttings within two weeks. It is practicable, when the cutting material is limited in quantity, to utilize also the middle and lower portions of the stem. In any case, two or three nodes should be included in each cutting, the lower being near the base to facilitate rooting. It is possible to secure a second set of cuttings from the original ones when they have grown to twice their original height, usually about three weeks after potting. The upper cuttings of the original stem are best adapted to this second series of cuttings, as the terminal growth is not interrupted. (Pl. I, fig. 1.)

The slips should be inserted in sand (Pl. I, fig. 2) and when the largest roots are three-fourths of an inch in length they should be transferred to 2-inch pots, and later on to 3-inch pots. (Pl. II, fig. 1.) The size which the plants can attain in such pots without becoming pot-bound will permit them to be transplanted to the permanent nursery rows, if the season be suitable, or to an outside cold frame (Pl. II, fig. 2), to remain dormant till spring, in case the cuttings are made during the winter. Greenhouse facilities are desirable, though not essential. It is possible with 30 square feet of greenhouse space and 90 square feet of cold frames to secure, during a single winter, 1,000 plants from an alfalfa plant of average size. In the northern portions of the United States the conditions of the weather may be too severe to permit of transfer to outside cold frames. In the southern portion of the country cold frame protection may not be necessary, but some means should be adopted to protect the plants from other sources of danger until they can be permanently transplanted.

The efficiency of the method is shown by the fact that at least 95 per cent of alfalfa cuttings become well rooted in the pots. The newly potted cuttings should be watered sparingly and shaded from direct sunlight for the first two days. Where it has been necessary to transfer the plants to cold frames at Washington, D. C., in midwinter, the loss has been as high as 10 per cent, owing to the sudden change of temperature. Cloth protection is recommended, as the plants, having been grown in the greenhouse, are likely to be tender.

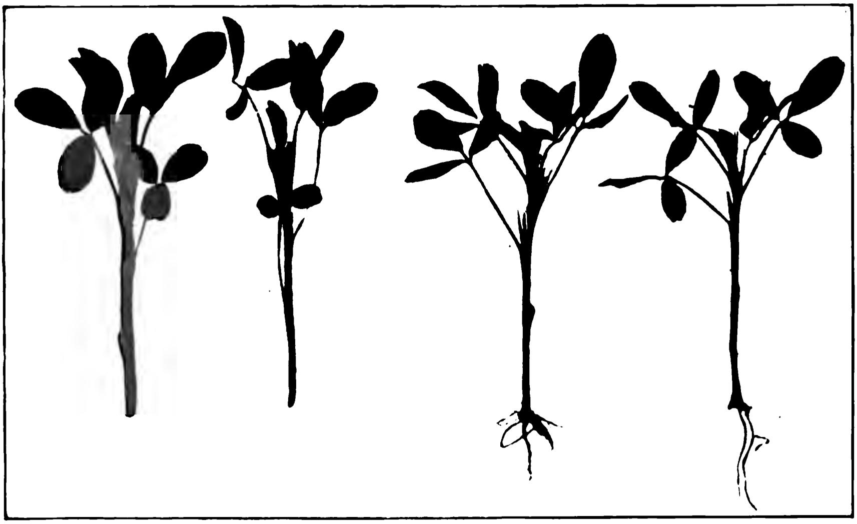

FIG. 1.—CUTTINGS OF PERUVIAN ALFALFA BEFORE AND AFTER ROOTING.

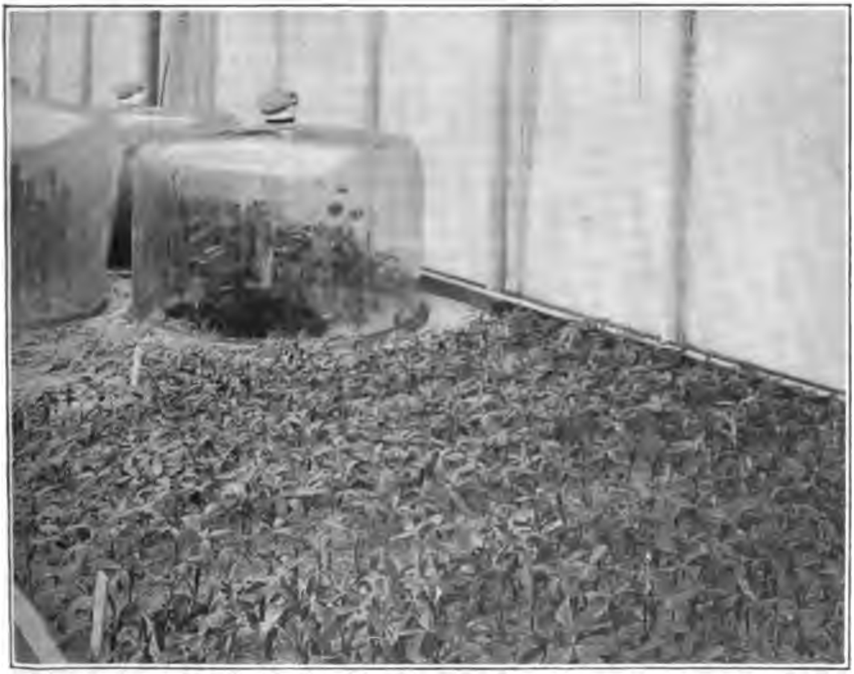

FIG. 2.—CUTTINGS OF PERUVIAN ALFALFA ROOTED IN SAND IN GREENHOUSE.

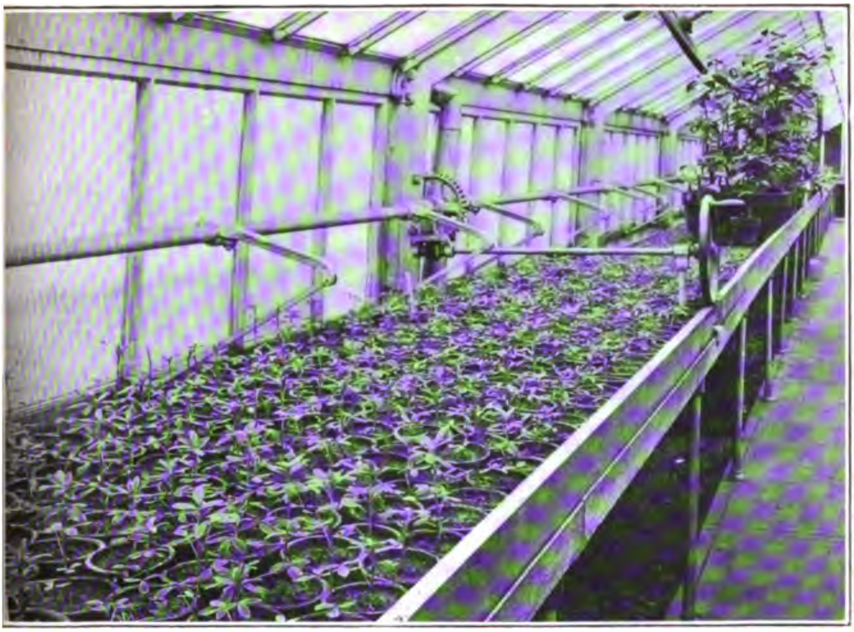

FIG. 1.—POTTED CUTTINGS OF PERUVIAN ALFALFA IN GREENHOUSE.

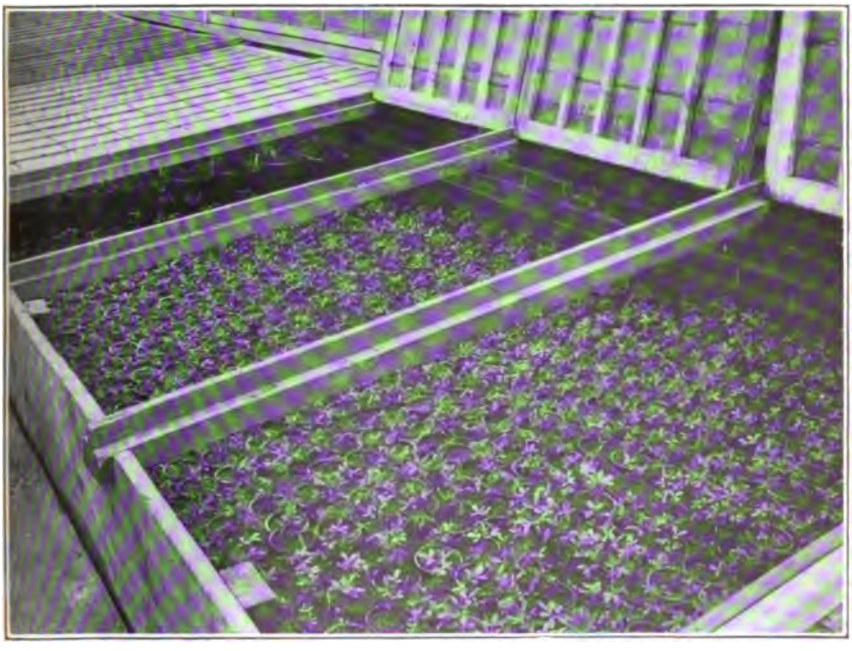

FIG. 2.—POTTED CUTTINGS OF PERUVIAN ALFALFA IN COLD FRAMES.

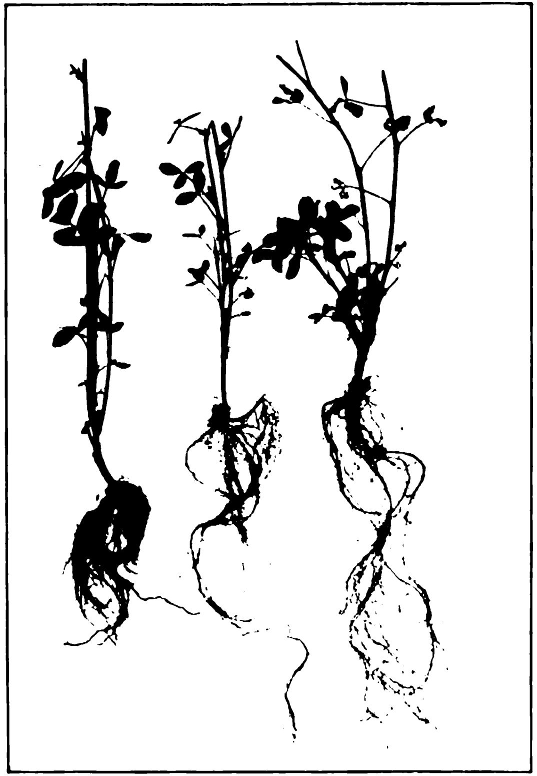

FIG. 1.—ROOTED CUTTINGS OF PERUVIAN ALFALFA READY FOR TRANSPLANTING TO PERMANENT

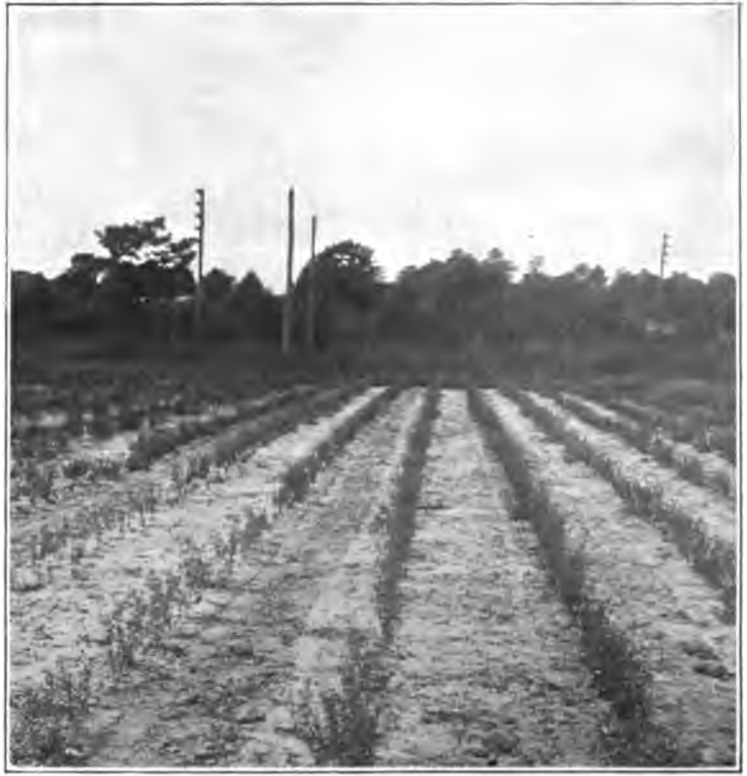

FIG. 2.—PLANTS FROM CUTTINGS OF PERUVIAN ALFALFA IN PERMANENT NURSERY ROWS.

No losses resulted on one occasion in the transfer of 1,800 plants to the permanent nursery rows 5 miles distant. The tops were cut back to 6 inches in height before being removed from the pots in the cold frames. (See Pl. III, figs. 1 and 2.)

APPLICATION OF THE METHOD TO PRACTICAL PLANT-BREEDING PROBLEMS.

In connection with establishing new varieties of such leguminous forage plants as alfalfa and clover it is sometimes desirable to start with a strain from a single individual, or at best from a limited number of individuals. This is the case where an especially promising form is confined to so few plants that the problem of increasing the stock for further tests and possible introduction is a serious one. In work of this kind many difficulties have heretofore been encountered. The seed selected from a promising set of individuals in an ordinary nursery or testing plot may have as its male parents plants of all of the strains in the series under test, a circumstance which works against the fixing of the strain along the desired lines.

This promiscuous parentage can usually be avoided only by keeping the remainder of the plants clipped to prevent flowering. This is not practicable in case other strains are being developed at the same time. While it is possible to isolate several hundred plants so that the danger of outside pollination is for the most part eliminated, yet with a few plants this is much less satisfactory, as there is not the protection of numbers which a considerable area of plants of one strain gives. The several hundred plants which can readily be produced from the selected individuals during the winter can be isolated by transfer to a considerable distance from other plants of the same or closely related species. It is possible that a considerable area could be practically isolated by lateral screens to confine the fertilizing insects temporarily to the plants in question. Under these conditions the presence of great numbers will make it probable that the bulk of the seed secured will have the selected individuals for its male parents.

The quantity of seed procurable from a few plants is usually so small that several seasons are required to obtain sufficient stock for even the preliminary tests of the new strain under field conditions. But by using cuttings it is quite practicable to produce in the greenhouse as many plants from one individual during the first winter as would be expected in at least two years from seed. Therefore this method results in a considerable shortening of the time required to get the seed of any one selected strain in sufficient quantities for field tests.

In practical selection work where strains resistant to cold, drought, or disease are being developed, natural selection will weed out the undesirable plants. In these cases the method suggested by Hays[a] is most practicable. In case, however, the selections are being made along different lines, as for yield, leafiness, or composition, there can be no natural elimination of the undesirable individuals. Artificial elimination in many cases is tedious, as, for instance, when selection for composition is in progress. The method here described will enable fixed strains to be secured in a much shorter time than where the seed is influenced by pollen from inferior individuals.

In cases where there is at hand but a single individual of a given strain its possible destruction by accident may be guarded against by increasing the stock, as here suggested. If the preliminary tests show it to be of probable value, the question of seed production can then be considered.

The transplanting of matured alfalfa plants is difficult, owing to their great root development. It is much more expedient to make cuttings to the required number and transplant these to the desired location.

In experimental tests, such as fertilizer pot trials with single plants, it is well known that the individual variations of the different plants utilized is a varying factor, for which it is difficult to make corrections. This factor is practically eliminated where the plants under test are produced by cuttings from a single individual. It is suggested that in fertilizer tests, for instance, where pots or even small plots are used, the experiments can be rendered less liable to error by utilizing freshly rooted cuttings of a single individual for the entire series of experiments.

In view of the bearing which the self-fertility of a given species has upon the application of the method to starting a strain from a single individual, a list of self-sterile and self-fertile plants is here given. This list is from Kirchner,[b] based in part upon his own work and, in part, upon that of others. Those plants listed as self-sterile failed to set seed when the inflorescence was bagged, while the self-fertile species produced seed when similarly covered.

Self-sterile.—Medicago sativa, M. falcata, Trifolium pratense, T. hybridum, Vicia cracca, V. angustifolia, V. villosa.

Self-fertile.—Melilotus alba, Medicago carstiensis, M. denticulata, Trifolium repens (slightly), T. incarnatum (slightly), Ornithopus sativus, Cicer arietinum, Vicia sativa, V. faba, Lens esculenta, Lathyrus sativus, L. tingitanus, Pisum sativum, Glycine hispida, Phaseolus vulgaris, Vigna sinensis.

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[a] Hays, W. M. A Method of Breeding a Hardy Alfalfa. American Breeders' Association, vol. 1, 1905.

[b] Kirchner, Q. Ueber die Wirkung der Selbstbestäubung bei den Papilionaceen. Naturw. Zeitschrift für Land und Forstwirthschaft, parts 1, 2, and 3, 1905. Digest in Bot. Centralbl., Vol. XCVIII, No. 18, p. 449, 1905.

The behavior of any species under continued inbreeding will determine the minimum number of plants which can be utilized as the foundation stock for a given strain. It is, of course, impossible to start with a single individual in case it is absolutely sterile to its own pollen. It may be, however, that the differentiation incident to vegetative propagation permits the use of pollen of plants derived from the same individual. If this last condition does not obtain, the employment of at least two individuals is essential. These should, of course, be as nearly identical as possible with regard to the desired characteristics.

The legumes are variable in respect to self-pollination, and unfortunately there still remains a great deal of work to be done in this direction, as many of the early experiments were not performed under as rigid conditions as might be wished. It is probable that many flowers failing to set seed when bagged fail not because they are sterile to their own pollen, but because of abnormal conditions incident to the bagging. A series of experiments is in progress to determine whether a number of the species of legumes usually regarded as self-sterile are not to a certain extent self-fertile, at least to pollen from other portions of the same plant or from another plant produced from a cutting from the same individual.

B. P. I.—261.

THE CONTROL OF TEXAS ROOT-ROT OF COTTON.[a]

By C. L. SHEAR, *Pathologist*, and GEORGE F. MILES, *Scientific Assistant in Pathology.*

INTRODUCTION.

Root-rot, or the so-called "dying" of cotton, is each year becoming a more and more serious enemy of the cotton grower in Texas and other parts of the Southwest. It has not yet been found east of Texas, but it is likely to spread gradually eastward. The extent of its damage to the cotton crop during the past season (1906) was apparently greater than ever before. It has been estimated that the total loss caused by this disease in Texas last year was about $3,000,000. During seasons favorable to the development of the parasite it increases its area of destruction quite rapidly. Some cotton planters have expressed the opinion that this disease is at present a more serious menace to the cotton crop of Texas than the boll weevil.

Root-rot is not restricted to cotton, but attacks a large number of other cultivated and wild plants.

CAUSE OF ROOT-ROT.

The disease has been attributed by planters to a variety of causes. Our investigations have shown, however, that it is primarily due to a fungous parasite which lives and spreads in the soil. This fungus is known as a species of Ozonium and is most prevalent and injurious in the Houston clay or black waxy soils of the Southwest. Under favorable conditions of temperature and moisture, the fungus attacks the roots of the cotton plants, destroying the rootlets and external surface of the roots and also invading the fibro-vascular system, thus causing the plants to suddenly wilt and die. This organism grows best where the aeration of the soil is poorest. The disease may be easily recognized by the sudden wilting and dying of the plants and the presence on the roots of dirty yellowish strands or a thin weft of the fungous filaments.

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[a] The results of the field experiments conducted by Doctor Shear and Mr. Miles last season (1906) were so promising that it is deemed desirable to present them to cotton growers at once. Further time will be required to complete the investigations and demonstrate more exactly the value of the method recommended.—B. T. GALLOWAY, *Pathologist and Physiologist, and Chief of Bureau.*

EFFORTS TO CONTROL THE DISEASE.

Our investigation of this disease, including the tests of possible methods of prevention or control, is not yet complete. A considerable variety of tests has been made in the application of various fungicides and other chemicals and fertilizers to the soil, and attempts have also been made to secure by selection a race or variety of cotton that might be immune or show some degree of resistance to the disease. Neither of these lines of investigation has yet given promise of success.

ROTATION OF CROPS.

It is generally known to planters familiar with root-rot that it does not affect grasses and grains, and when such crops are grown upon infected land for a few years the succeeding cotton crop is not likely to suffer so badly. The beneficial results from such rotations alone are, however, not always uniform or satisfactory.

AERATION OF THE SOIL BY DEEP PLOWING.

Field and laboratory investigations, coupled with the exper[illegible] of practical growers, have led the writers to conclude that la[illegible] proper aeration of the soil is one of the most important factors f[illegible] ing the development of the root-rot fungus. Deeper plowing [illegible] that usually practiced in ordinary cultivation methods improve[illegible] aeration of the soil and was therefore tried.

Three series of experiments were conducted, consisting of (1) [illegible] fall plowing, the land being plowed to a depth of 7 to 9 inch[illegible] December 7 and 8, 1905, (2) deep spring plowing, and (3) s[illegible] subsoiling.

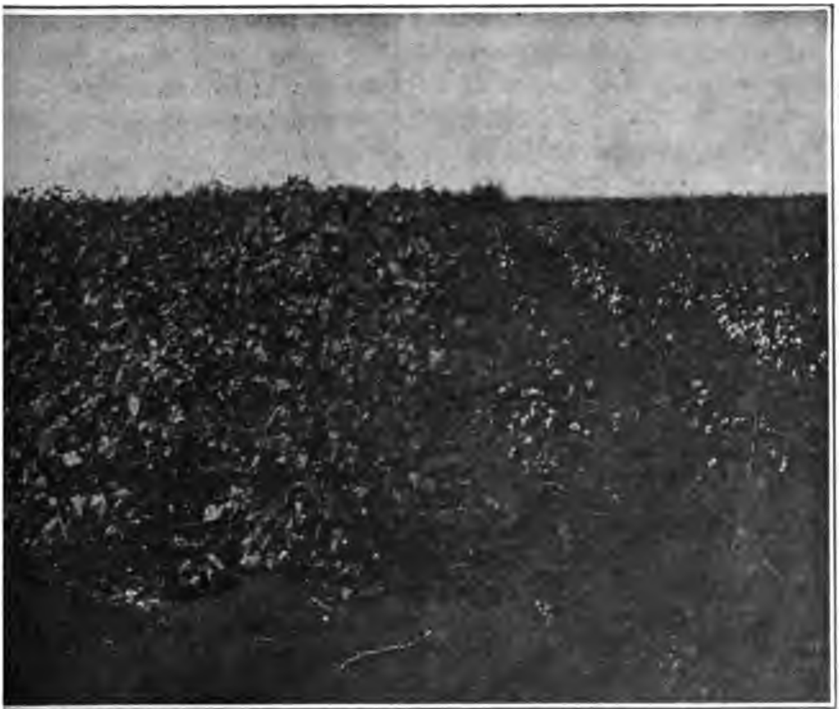
DEEP FALL PLOWING.

The experiment in deep fall plowing was carried on near L[illegible] Tex. An area was selected where the cotton was nearly all k[illegible] by the root-rot during the previous season. Three acres of this [illegible] were plowed 7 to 9 inches deep; the remainder was given the ordinary preparation and cultivation, being simply bedded up with a "middle buster" in the spring. The cotton on both plats was planted at the same time and treated in the same manner during the season. On October 25, 1906, by an actual count of the plants in 15 rows of each plat, representing the average condition, only 12 per cent of the plants on the deep-plowed plat were found to be dead, while on the check plat adjoining, which had received ordinary preparation, 96 per cent of the plants had been killed by the disease.

DEEP SPRING PLOWING AND SUBSOILING.

The results of the deep spring plowing and subsoiling were not so atisfactory, though there was a very noticeable benefit from this reatment. The plants on the subsoiled land showed much less rot han those on the land which was plowed deep. The cotton was oticeably larger and more productive on all the treated plats, and specially on that which was subsoiled.

The accompanying illustration of our experimental plat at Petty, ex., from a photograph taken October 19, 1906, shows on the left oot-rot-infected land treated by spring subsoiling and on the right



IG. 3.—Cotton field badly infested with the root-rot, showing the result of spring subsoiling. The plat at the left, subsoiled, shows the cotton mostly alive, and the plat on the right, prepared in the ordinary way, shows the cotton nearly all dead.

he check plat which received ordinary preparation. The contrast as not so great, however, throughout the whole area. It was mpossible to obtain satisfactory photographs of the plats treated y deep fall plowing, as the leaf worm had destroyed the foliage.

TREATMENT RECOMMENDED.

The benefit derived from deep fall plowing is so remarkable that t seems desirable to call the attention of cotton growers to this method of controlling the root-rot. The deep fall plowing should be combined with rotation of crops, using, for two or three years previous to planting cotton on the land, some of the grasses or grains best adapted to the requirements of the particular locality. This course has proved most practicable and successful in combating this disease.

In order to attain success by this method the plowing must b very thoroughly done and at the proper time. Good results ca not be secured unless the land is plowed to a depth of at least inches, and 9 inches would be still better. This work can not b done with the small plows in general use by cotton planters. good disk plow or a 12 to 14 inch plow of the ordinary form mus be used. In the experiments of the writers the plowing was don early in December. We believe it would be better to do it i November, as the soil would have a greater opportunity to becom aerated; but if it is impossible to do the plowing in the fall i should be done during the winter or early spring.

P. I.—274.

THE HISTORY OF THE COWPEA AND ITS INTRODUCTION INTO AMERICA.[a]

By W. F. WIGHT, *Assistant Botanist, Taxonomic Investigations.*

INTRODUCTION.

The purpose of this paper[b] is to give a brief history of the introduction of the plant known as the cowpea (*Vigna unguiculata*) into America, to establish as nearly as possible the time at which it was introduced, and to ascertain the region to which it is native.

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[a] Although the cowpea is the chief leguminous crop of the southern United States, the most diverse and often erroneous ideas prevail in regard to its geographic origin and the time and means of its introduction into American agriculture. It has been maintained by some, for example, that it is a native of tropical America; by others, that it was brought from Africa by the negro slaves, and by still others that it was introduced by the United States Department of Agriculture.

Because of the bearing of the question on certain introduction and breeding experiments with cowpeas, Mr. A. J. Pieters, then in charge of the seed introduction and distribution work of the Department, started an inquiry into the subject, intrusting the work to Mrs. K. S. Bort, who made extensive extracts from the literature of cultivated plants. So many questions arose, however, requiring the consideration of a botanist trained in the critical discrimination of plants and with a wide knowledge of botanical literature, that Mr. W. F. Wight was assigned to the task. He has made a thorough investigation of the history of the cowpea, and in the accompanying paper has brought forward proofs of the principal points in that history, namely, that the cowpea is a native of the Afghanistan region; that it was introduced into the West Indies over two hundred years ago, and that it subsequently was brought to the American mainland, gradually extending northward until, about 1797, it reached the latitude of the Potomac and attracted the attention of such a keen agriculturist as Washington himself.—FREDERICK V. COVILLE, *Botanist in Charge of Taxonomic Investigations.*

[b] The author wishes to acknowledge his indebtedness to Mr. Frederick V. Coville for Latin and Greek translations and for many suggestions; to the Chinese Legation for translation from the Chinese; to Mr. S. Stefansson, of the Library of Congress, for translation of Arabic; and to Mr. C. M. Mansfield, of the Bureau of Plant Industry, for photographs.

The conclusions which have been drawn are, briefly, that it was introduced into the West Indies during the latter half of the seventeenth century and probably reached the mainland during the first half of the eighteenth century; that it is a native of India and the region northwestward to the southern part of the trans-Caspian district; that its cultivation in that region is of ancient date; that its cultivation extended to China at a very early period; that it was known in Arabia and Asia Minor as early as the beginning of the Christian era, and was cultivated in at least one of the countries of southern Europe at about the same time, but that its introduction into central Europe was of much later date and entirely independent of its introduction into southern Europe.

HISTORY.

The nativity of several economic plants that have been in cultivation for a very long period is extremely difficult of determination. This difficulty is especially great in the case of the cowpea (*Vigna unguiculata*), because of its similarity to some other leguminous plants likewise in cultivation for several centuries, and the vague way in which these plants were described or alluded to by early authors.

It is evident from the statements of these authors that more than one bean-like plant was in cultivation in southern Europe before the discovery of America. It may be inferred also that at least one of these plants bore a close resemblance to the common or kidney bean[a] (*Phaseolus vulgaris*), since this species was introduced into Europe without apparently receiving the attention that a plant more unlike any known to them would have attracted. The statements regarding the origin of maize, for instance, are much more definite than those concerning the species of beans. Many of the botanical authors who wrote during the century following the discovery of America and the introduction of American species into Europe, like their predecessors, sought to identify the beans cultivated at the time they wrote with the bean-like plants described by Theophrastus and Dioscorides. This tendency is doubtless at least partly responsible for their failure to distinguish clearly the species then cultivated. De Candolle, in the "Origin of Cultivated Plants," while doubting the identity of *Phaseolus vulgaris* with any of the plants known to the ancients, after discussing the origin of the words applied to *P. vulgaris* in several European languages, says (p. 339): "Nevertheless, he *dolichos* of Theophrastus has been definitely referred [by other authors] to the *scarlet runner* [*Phaseolus coccineus* (*P. multiflorus* Lam.)], and the *fasiolus* to the dwarf haricot [*Phaseolus vulgaris*] of our gardens * * * . I can only say it may be so." Again (p. 347): "*Lobion* in Dioscorides is the fruit of *Ph. vulgaris*, at least n the opinion of commentators."

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[a] In this paper the expression "the common bean" is not used to designate any particular one of the many garden varieties of *Phaseolus vulgaris*, but is applied to all the forms of the species. The term "kidney bean" is used by the English and "haricot bean" by the French in the same sense.

De Candolle, however, apparently did not examine very carefully the evidence of the American origin of these plants. The early accounts of discovery in America contain references to leguminous plants which indicate that they were extensively used by the natives of the New World.

Hariot, 1588, "A Brief and True Report of the New Found Land of Virginia," mentions two kinds: One, "Okindgier, called by us *Beanes*, because in greatness and partly in shape they are like to Beanes in England; saving that they are flatter, of more divers colours, and some pide. The leafe also of the stemme is much different." The other plant, "Wickonzowr, called by us *Peaze*, in respect of the beanes for distinction sake, because they are much less; although in form they little differ; but in goodness of taste much, and are far better than our English peaze." Captain John Smith, 1612 (Workes, 62), writes: "They plant also pease they cal Assentamens, which are the same they cal in Italye, *Fagioli*. Their Beanes are the same the Turkes cal Garnanses, but these they much esteeme for dainties."[a] The same author, 1616 (Works, 207), in a description of New England, mentions "beans and pease" among the "hearbes and fruits," but gives no descriptions. Josselyn, 1675 (Voyages, 73–74), distinguished four kinds of beans or peas, "French beans; or, rather American beans. The herbalists call them kidney-beans, from their shape and effects; for they strengthen the kidneys. They are variegated much—some bigger, a great deal, than others; some white, black, red, yellow, blue, spotted; besides your *Bonivis*, and *Calavances*, and the kidney-bean that is proper to Ronoake. But these are brought into the country; the others are natural to the climate." Lawson, 1714 (History of Carolina, 130, 131), mentions several kinds of "pulse" as "bushel bean," "Indian rounceval, or miraculous peas," "bonavis," "calavancies," and "nanticokes." He also says "the kidney beans were here before the English came, being very plentiful in the Indian corn fields." Brickell, 1737 (Natural History of North

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[a] Gray and Trumbull, 1883, American Journal of Science, 26: 132, think these names are confounded. "*Garvance* was the French name of the Chick Pea (*Cicer arietinum*), the Spanish *garbanzo;* and it is not probable that the 'Turks' gave this name to any kind of beans; while *fagiuoli* was the Italian equivalent of Latin *phaseoli*. Strachy's Virginian vocabulary gives *assentamens* (and otassentamens) for 'pease,' and *peccatoas*, *pekctawcs*, for 'beans.'"

Carolina, 16, 17), describes the beans of the country in the following language:

> There are several sorts of Pulse in this Province; and first, the *Bushel Bean*, so called from producing a Bushel of Beans or more from one that is Planted; they are a Spontanious product in *Carolina*, and are Set in the Spring round Arbours, or near long Poles set in the Ground for that purpose, where they make a good Shade to sit under in the extremity of hot Weather; they continue Budding, Flowering, and Ripening all the Summer, until the approach of Frost, which prevents their farther Growth, and so dye; They climb prodigious high, and their Stalk is about the thickness of a Man's Thumb, the Pod grows like the *Kidney Bean*, but the Bean is flat, white, or mottled, with a purple Colour: They are extraordinary good, and well relished Pulse, either by themselves or with Meat.
>
> The *Indian Rouncival*, or *Miraculous Pea*, so called from their long Pods and great Increase. These are a late Pea, and require a pretty long Summer to ripen and bring them to Perfection, they are a good Pulse, and in great plenty all over this Province with *Christians* and Indians.
>
> The *Bonavis* is another kind of *Pulse*, and yields a great Increase, it doth not require so long a Summer to ripen as the former, they grow like *Kidney-Beans*, and are very plenty in this Province.
>
> The *Calivances* are another kind of *Pulse*, resembling the former, but are not so flat, they are in great plenty in most of the Plantations amongst the Indian Corn. These and the *Bonavis*, afford two Crops in the Year, and are generally ripe and in full perfection in six Weeks time.
>
> The *Nanticoacks* are another kind of *Pulse*, and resemble the *Calivances*, and are in great plenty all over this Province.
>
> There are several other kinds of *Pulse* in this Province that we have no Name for, which are well known amongst the *Indians*, and are excellent Food.
>
> The *Kidney-Bean*, is likewise here in great plenty growing for the most part in every Corn-Field. The Indians had these four Sorts of *Pulse*, *viz.* the *Bonavis*, *Calivances*, *Nanticoacks*, and *Kidney-Beans*, and several other sorts, long before the Arrival of the *Europeans* amongst them; which Report I have had affirmed several times, not only from the *Christians*, but likewise from the *Indians* in these Parts.

These references and many others given by Gray and Trumbull, 1883 (American Journal of Science, 26: 130–138), and by Sturtevant, 1887 (American Naturalist, 21: 327–331), certainly justify those authors in the conclusion that *Phhseolus vulgaris*, *P. coccineus*, and *P. lunatus* are natives of the New World. Koernicke, 1885 (Verhandl. Nat. Hist. Rhein. & Westphal. Correspondenzblatt, 136), also arrived at the same conclusion in regard to *P. vulgaris*. The recent discovery of seeds identified as *P. vulgaris* in the remains of the mound builders in Ohio and of the cliff dwellers in New Mexico[a] affords evidence additional to that presented by the above authors of the nativity of that species. But among all the references given there is no positive evidence that any species of Dolichos or Vigna was in cultivation by the Indians for at least a hundred years after the first English settlement. The authors of the eighteenth century record a greater number of legumes than the authors of either the sixteenth or seventeenth centuries, and there are frequent references in the literature of that period to the introduction of seeds from the Old World. Not a single species of Dolichos is known except in a cultivated state in North America north of Mexico, and Hemsley does not enumerate any in the Biologia Centrali-Americana. Only one species of Vigna, *V. repens*, now found spontaneous throughout the Tropics, has the appearance of being indigenous to either North or Central America, while about 10 species of Phaseolus are known in a wild state in North America, and Hemsley enumerates 41 in the Biologia Centrali-Americana for Central America.

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[a] Wittmack, 1905, Trans. Acad. Sci. St. Louis, 15: 14.

The time at which important American food plants were introduced into England is also significant in regard to the origin of these plants. The following dates are given on the authority of Aiton (Hortus Kewensis, 1789): *Zea mays* was cultivated in 1562; *Nicotiana tabacum* before 1570, but the exact date is apparently not known; *Lycopersicon lycopersicum* was cultivated in 1596; *Phaseolus vulgaris* in 1597, and *P. coccineus* (*P. multiflorus* Lam.) in 1597. The date given for *P. lunatus* is 1779, but the figure and description of Gerard's third kind (Gerard, 1597, Herbal, 1039), correspond very closely to the so-called sieva type of *P. lunatus*, and it is possible that it had been introduced at an earlier date and, not meeting with favor, disappeared, but there is no evidence that *Vigna unguiculata* and *Dolichos sesquipedalis* were introduced into England before 1776 and 1781, respectively. With one possible exception, therefore, plants of undoubted American origin were cultivated in England more than a century and a half before *Vigna unguiculata* or *Dolichos sesquipedalis.* This would scarcely have been the case if the two last-named species had been cultivated in America for a long period, as the first-named were.

Of the two kinds distinguished by Hariot in 1588, the one called "Peaze" is without doubt the kidney bean, as it is called "Peaze, * * * for distinction sake * * * though in form they little differ" from the bean except in size. The latter is compared with the English bean (*Vicia faba*) in size and partly in shape, and is either a large form of kidney bean or the Lima bean. If the words "Fagiole" and "Garnanses" or garvanses are confounded by Smith, the "pease" which he mentions probably refers to a species of Lathyrus or Vicia, and the "Beanes" to the common kidney bean. There can be little doubt that "Garnanses" is a corruption of the Spanish *garbanzo*, French *garvance*. It has also been written "garavance," "garvancos," and "gravances." The writer has been unable to find this word used in Europe for any other plant than the chick-pea (*Cicer arietinum*), and although the introduction of seeds into America began as early as the second voyage of Columbus, it is improbable that the cultivation of the chick-pea could have been introduced among the Indians of the United States as early as 1612, and it is doubtful whether it was ever cultivated by them.

There is no evidence that it was cultivated to any extent by the colonists, though it was introduced some time previous to 1790. The name was probably applied by Smith to some plant with a superficial resemblance to the chick-pea, perhaps a vetch. There is at least no evidence that the plant called " garnanses " was a species of either Vigna or Dolichos. The name " calivance " was applied by Sloane, 1707 (Natural History of Jamaica, 1: 183), to the cowpea, and this word is believed to be a corruption of " garbanzo." The forms given in Murray (English Dictionary, under Calavance) are, " garvance," " caravance," " callavance," " callevance," " callvanse," " kalavansa," " callivancy," " callivance," " calavance." The earliest use of the word " calavance " that the writer has been able to find is by William Hughes, 1672 (The American Physician, or a Treatise of the Roots, Plants, Trees, Shrubs, Fruit, Herbs, etc., 17, 18), where he writes concerning " Calavance, or Calavances: "

> These Pease have long and small stalks, of a brownish green colour, branched and spread upon the ground (unless they be supported by Props) much after the same manner of our Field-pease; the leaves shoot forth at several places, set one against another, of a more yellowish green colour than ours in *England* are: They have also towards the top, clasping Tendrils, as ours have: The Cods are pretty long, wherein are small Pease of the bigness of our Vetches, but long; or of the fashion of a Kidney-bean, and very smooth; outwardly, of a dark red colour; neither are they uneven when they be dry.
>
> They grow in many places in *America*, as in *Jamaica*, at Colonel *Barington's* Plantations, at Ligance, at Portamorant, etc.
>
> They are planted at any time, and flourish all the year; of which the Husbandmen or Planters there, have five crops in two years.
>
> Some call them the *Indian Vetches*, some the *Indian Pease;* but those that are Inhabitants there, call them *Calavances*, or *Calievancie*.

The plant described by Hughes is certainly a plant with pinnate leaves and tendrils, like the chick-pea, but Sloane, 1696 (Catalogus Plantarum Jamaica, 71), cites " Calavance or calavances of Hughes, p. 17 (?)," under *Phaseolus erectus major*, which is a cowpea. The same author, 1707 (Natural History of Jamaica, 1: 183), under *Phaseolus erectus major*, says " Callavance Jamaicensibus dictus," without any indication of doubt. It would appear from these facts that the word was originally used in America to designate a vetch-like plant and that its application to the cowpea by Sloane was an error. Several authors subsequently adopted Sloane's usage of the name, and it is preserved at the present day in the form "galavant" as the name of one of the varieties of the cowpea.

The four kinds mentioned by Josselyn, 1675 (Voyages, 73–74), are " kidney-beans," "bonivis," "calavances," and the "kidney-bean that s proper to Ronoake."

Bonivis is clearly a corruption of Italian *Buona vista*, and Hughes, 1750 (Natural History of Barbadoes, 216), writes "*Buona Vista*, commonly called *Bonny-vis*." Its earliest use in America appears to be by Richard Ligon, 1657 (A True and Exact History of the Island of Barbadoes, 22, 24), "Maies, and Bonavists, planted between the boughs, the Trees lying along upon the ground; so far short was the ground then of being cleared." No description is given by which the name can be identified with a particular species, and its application can only be inferred from its later use by other authors. Sloane, 1696 (Cat. Pl. Jam., 67, 68), and 1707 (Nat. Hist. Jam., 1:177), uses bonavist for *Dolichos lablab.* The "Buona vista" of Hughes, 1750 (Nat. Hist. Barbadoes), is also certainly *Dolichos lablab.* Wherever the word "bonavist" in its various forms occurs with an identifiable description it refers to *Dolichos lablab.* Josselyn's "calavances," like that of William Hughes, is probably a plant with pinnate leaves. Certainly no variety of *Vigna unguiculata* then known would mature seeds in New England. The "kidney-bean that is proper to Ronoake" may be either the Lima bean, the scarlet runner, or one of the numerous varieties of the kidney bean.

The "bushel bean" of Lawson is probably *Phaseolus lunatus.* Sturtevant, 1885 (Amer. Nat., 19:454), has suggested that the "Indian rounceval, or miraculous peas," may have been *Dolichos sesquipedalis*, but it would have been more natural for an Englishman to have applied the term to a plant more nearly resembling the English rounceval. Lawson's "bonavis" is doubtless *Dolichos lablab*, but "calavancies" and "nanticokes" are scarcely identifiable, though the latter is probably one of the various forms of the kidney bean. Brickell gives nearly the same description of bushel bean and Indian rounceval as found in Lawson; in fact, the wording is so familiar that it is without much doubt copied from the earlier author. There is less doubt, however, regarding the "Calivances" of Brickell. They resembled the bonavis, except that they were not so flat. This clearly refers to some other plant than a Vicia or Lathyrus, and though it can not be identified from the descriptions, it must be either a form of *Phaseolus vulgaris* or perhaps the red-seeded form of *Vigna unguiculata*, the "callavance" of Sloane.

Jamaica was captured by the British in 1655, and possession was confirmed by treaty in 1670. William Hughes (The American Physician, etc., published in 1672), describes several plants cultivated in

Jamaica, but does not include *Vigna unguiculata*, his calavance, as noted above, being a different plant. If *Vigna unguiculata* had been cultivated in Jamaica at that time it would probably have been mentioned with the other cultivated legumes Hughes described. Sloane visited the island in 1687, remaining fifteen months, and found both the red and white seeded forms, and it is therefore very probable that they reached Jamaica some time between the years 1672 and 1687. Any plant that had been found valuable in Jamaica would no doubt soon be tried in the southern colonies, for the early accounts of the colonies indicate that they frequently obtained seeds of new plants for trial. The Georgia colony even sent a man to the Spanish West Indies to secure new plants (Francis Moore, 1744, A Voyage to Georgia, Georgia Historical Society, 1840, 1:99). It is therefore possible that even the calavance of Lawson, 1714, is *V. unguiculata.* The statement of Brickell, 1737 (Natural History of North Carolina), that these plants were in America before the arrival of the Europeans can scarcely be taken seriously, for he makes it on the authority of the settlers and Indians who would easily confuse plants so similar in appearance as *Vigna unguiculata* and *Phaseolus vulgaris.* The exportations of peas mentioned by some of the early historians probably refer to English peas, as Lawson, 1714 (Hist. Carolina, 130, 131), says English peas " have been made trial of " and " yield very well."

The first unmistakable reference to the occurrence of *Vigna unguiculata* on the mainland of America appears in Romans (1775), Natural History of East and West Florida, 122, where the author says: " Pease, as they are here called but improperly, because species of the *Phaseolus* and *Dolichos* are meant, follow the maize in utility. It is well known that most people use them like European pease either green or dry, and some kinds, such as the small white sort, the bonavist, cuckolds increase, the white black-eyed pea, the white crowder, and many others, are undoubtedly at least as good." The " small white sort " is doubtless a white variety of the common bean; bonavist probably refers to *Dolichos lablab.* " Cuckolds increase " is applied by Patrick Brown, 1756 (Natural History of Jamaica, 292), to a species which he says resembles his seventh species, " Phaseolus erectus major," Sloane, which is *Vigna unguiculata.* Lunan, 1814 (Hortus Jamaicensis, 1:434), says the " cuckolds increase " " seems to be a species of *dolichos*, as does the bonavist." The white black-eyed pea is undoubtedly identical also with the black-eyed pea of Jamaica, another common form of *Vigna unguiculata.* The " white crowder " does not appear to be described by either Sloane or Brown. With the exception of the " small white sort " and the " white crowder " the names given by Romans were also given by Brown nineteen years earlier, and by Lunan thirty-nine years later, and the fact that the names "calavance," "bonavist," "cuckolds increase," and "black-eyed pea" all appear in the natural history literature of the West Indies earlier than they occur in the accounts of the American colonies indicates that they came from the West Indies to the mainland. Lunan, 1814 (Hortus Jamaicensis, 1:167), under "Dolichos" says: "Besides the above indigenous species, three exotic ones have been introduced, the lablab, of which arbours are made in the East; the *sinensis*, or Chinese dolichos; and the catjang, which is said to be cultivated for food in the East Indies."

The discussion given by Romans indicates that "pease" had been grown in the southern colonies for several years, long enough at least for their use to become "well known." In Virginia, however, there is evidence that *Vigna unguiculata* was not cultivated, at least to any extent, at so early a date. The correspondence of Washington affords interesting evidence of this fact. A letter dated Hyde-Park, Fairfax County, November 18, 1791, in reply to a circular letter sent out by Washington (Letters on Agriculture to Arthur Young and Sir John Sinclair, edited by Franklin Knight, 51, 1847), contains the following statement:

> As to pease, beans, potatoes, and turnips, our lands yield them very well, but as they are not raised for market in general I can not say what may be their average product per acre. It has ever appeared to me that if the farmers in Europe, who lay so much stress upon these articles in their writings, had our excellent substitute for them, Indian corn, they would only regard them as we do, for culinary purposes.

Washington was accustomed to growing seeds of new plants that might prove of agricultural value, and there are frequent references in his correspondence to seeds which had come from England or other countries and of which he wished the gardener to take particular care. The following are mentioned in Washington's correspondence, besides the staple crops of corn, wheat, etc.: Lucern, sainfoin, India hemp, buckwheat, furze, flax, white bent-grass, everlasting peas, and English field peas.

It was Washington's practice, sometimes, at least, to plant potatoes with corn, since in a rotation of crops recorded in "George Washington and Mount Vernon," edited by M. D. Conway, 287, 1889, "Indian corn, with intermediate rows of potatoes, or any root more certain or useful (if such there be) that will not impede the plough, hoe, or harrow in the cultivation of the corn," is given for one crop of the rotation. There is apparently no reference in any letter of Washington to the cultivation of peas or beans with corn. He used buckwheat as a green manure.

The first reference by Washington to the cowpea is in a letter to Landon Carter, of Cleve, dated Philadelphia, 27th February, 1797, in which he says: "I hope, as the season is approaching fast when the ground should be prepared for it, that you have informed Mr. James Anderson (my manager) in a letter directed to the care of the postmaster in Alexandria, at what time he may send for the peas you were so obliging as to promise me;" and the following from a letter of James Anderson to Landon Carter, which accompanied the above letter of Washington. "I have only to add to that wrote by the President—that the sooner you have 40 bushels of the White Indian pease, with black eyes—ready, you will the more oblige the President, I do not wish any of the small kind either the round kind called the Gentlemen pease, nor of the other small kind which resemble the large."

Jefferson, 1801 (Notes on the State of Virginia), makes no mention of peas or beans, although he enumerates the cultivated plants (p. 58), saying—

> Our farms produce wheat, rye, barley, oats, buckwheat, broom corn, and Indian corn. The climate suits rice well enough, where the lands do. Tobacco, hemp, flax, and cotton, are staple commodities. Indigo yields two cuttings. The silk-worm is a native, and the mulberry, proper for its food, grows kindly.
>
> We cultivate also potatoes, both the long and the round, turnips, carrots, parsnips, pumpkins, and ground nuts (Arachis). Our grasses are lucerne, St. foin, burnet, timothy, ray and orchard grass; red, white, and yellow clover; greensward, blue grass, and crab grass.
>
> The gardens yield musk-melons, water-melons, tomatos, okra, pomegranates, figs, and the esculent plants of Europe.

Beans and peas are not mentioned, and it may therefore be inferred that neither was at that time of sufficient importance in northern Virginia to be listed among the farm crops. A legume, probably *Vigna unguiculata*, was, however, cultivated in the cornfields to some extent in southern Virginia some years earlier than the publication of Jefferson's Notes.

Dr. James Greenway, of Dinwiddie County, Va., in an article on *Cassia chamaecrista* as a soil renovator (Transactions of the American Philosophical Society, 3:226, 1793), says the "common cornfield-pea is far preferable to everything that I have seen tried for this purpose. Every farmer who leaves his pea vines on the ground, and does not in the accustomed manner, pull them up for fodder, must often have observed that they quickly moulder and fall to pieces; furnishing a covering to the ground, which readily unites and blends with it, in the manner mentioned of the bean" [i. e., *Cassia chamaecrista*].

A catalogue of the plants found growing near Lancaster, Pa., by Muhlenberg, 1793 (Transactions of the American Philosophical Society, 3: 157), in which cultivated and introduced plants are given, as well as wild plants, does not mention any Dolichos or Vigna. The cowpea evidently had not then reached that locality.

It may be seen from the facts presented that there is no evidence that *Vigna unguiculata* was one of the native beans of America. On the contrary, it appears to have been first introduced into Jamaica at some time between 1672 and 1687 and to have reached one or more of the southernmost colonies, probably from Jamaica, sometime after the latter date, but before 1737, and its use to have extended gradually northward until it reached the Potomac about 1790 or 1795.

Notwithstanding the confusion wrought by commentators seeking to identify *Phaseolus vulgaris* with one of the climbing plants of Theophrastus and Dioscorides, European botanical literature affords very convincing evidence of the Old World origin of *Vigna unguiculata.*

Phaseolus vulgaris appears to have reached central Europe about 1536, and many authors at once identified it with Dioscorides's Smilax kepaia, or, as translated into Latin, Smilax hortensis. The species is discussed by Brunfels, 1536 (Herb. Viv. Ic., 3: 130), and identified on the authority of Heironymus Tragus with Dioscorides's plant. Brunfels in his Exegesis omnium simplicium Dioscorides (Brunfels,[a] 1532, Herb. Viv. Ic., 2: 114), does not identify Smilax more than to say that, according to Barbarus, it is a kind of phaseolus, and it is evident that *Phaseolus vulgaris* was not known to this author when volume 2 of his work was written. Bock, 1546 (Kreuterbuch, 236), has a good colored figure of the kidney bean, and says it has lately come into Germany.

Matthiolus, 1588 (Opera, 341), says that phasioli are common in Italy, but he apparently confuses the dwarf form of *Phaseolus vulgaris* with the "phasiolus" of the ancients. No stipules are shown in his figure, and it is probably *Phaseolus vulgaris.* In the earlier editions of Matthiolus's works, which appeared while the author lived in Italy and southern Austria, no bean with "black-eyed" seeds is described among the various sorts of "phasiolus." In a later work, Matthiolus, 1565, Commentarii, 429, the dedication of which was written at Prague, and dated January, 1565, seeds with a black ring about the eye are described, but the figure is the same as in the work issued in 1558. In Camerarius's edition of Matthiolus, 1586 (De plantis epitome utilissima, 212), however, the figure of phaseolus is *Vigna unguiculata.* It is certain that a low-growing leguminous plant, resembling the dwarf form of *Phaseolus vulgaris*, was cultivated in the Mediterranean region of southern Europe before the discovery of America. Several of the ancient treatises on agriculture give cultural directions for such a plant. Many, if not all, of the botanical authors after Dioscorides mentioned phaseolus, and Albertus Magnus, who lived in the thirteenth century, used the word "faselus" for a plant which had seeds with "a black spot at the hilum." Caesalpin, 1583 (De Plantis, 238), also described "phaselus" as having seeds with a black pupil.

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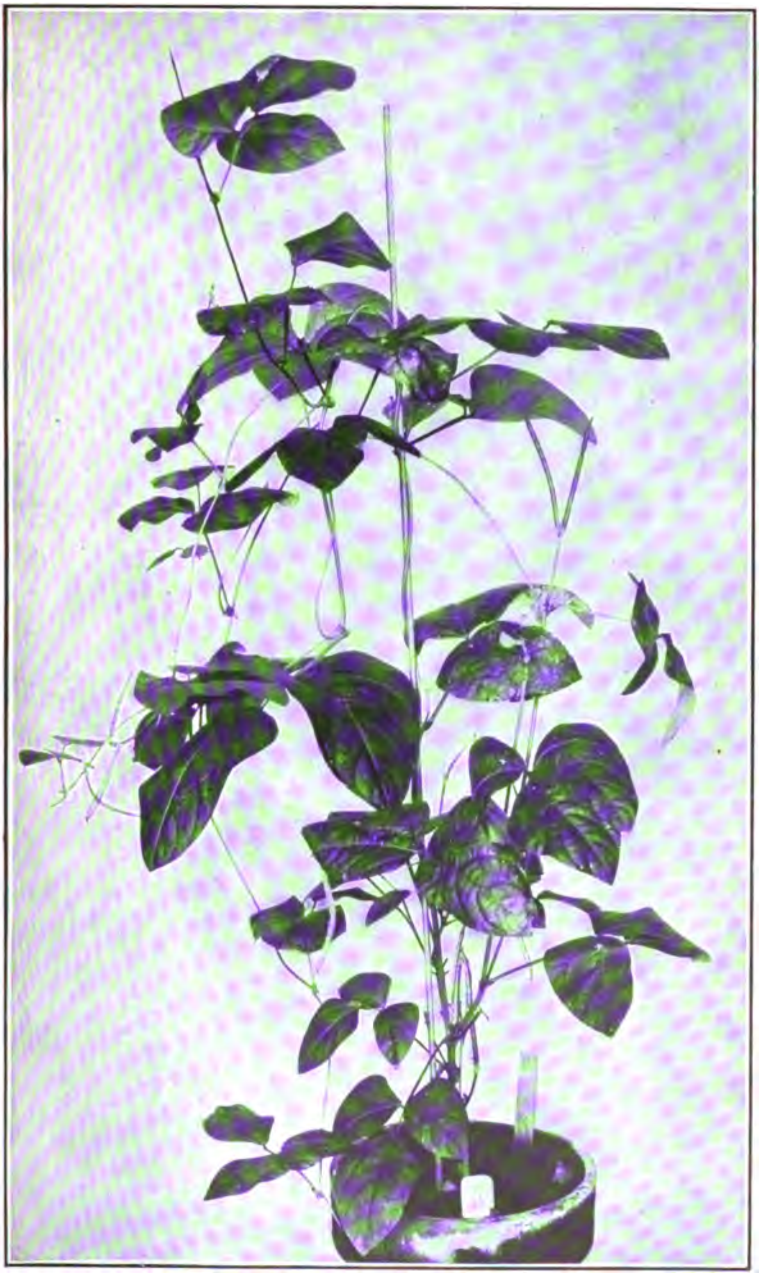
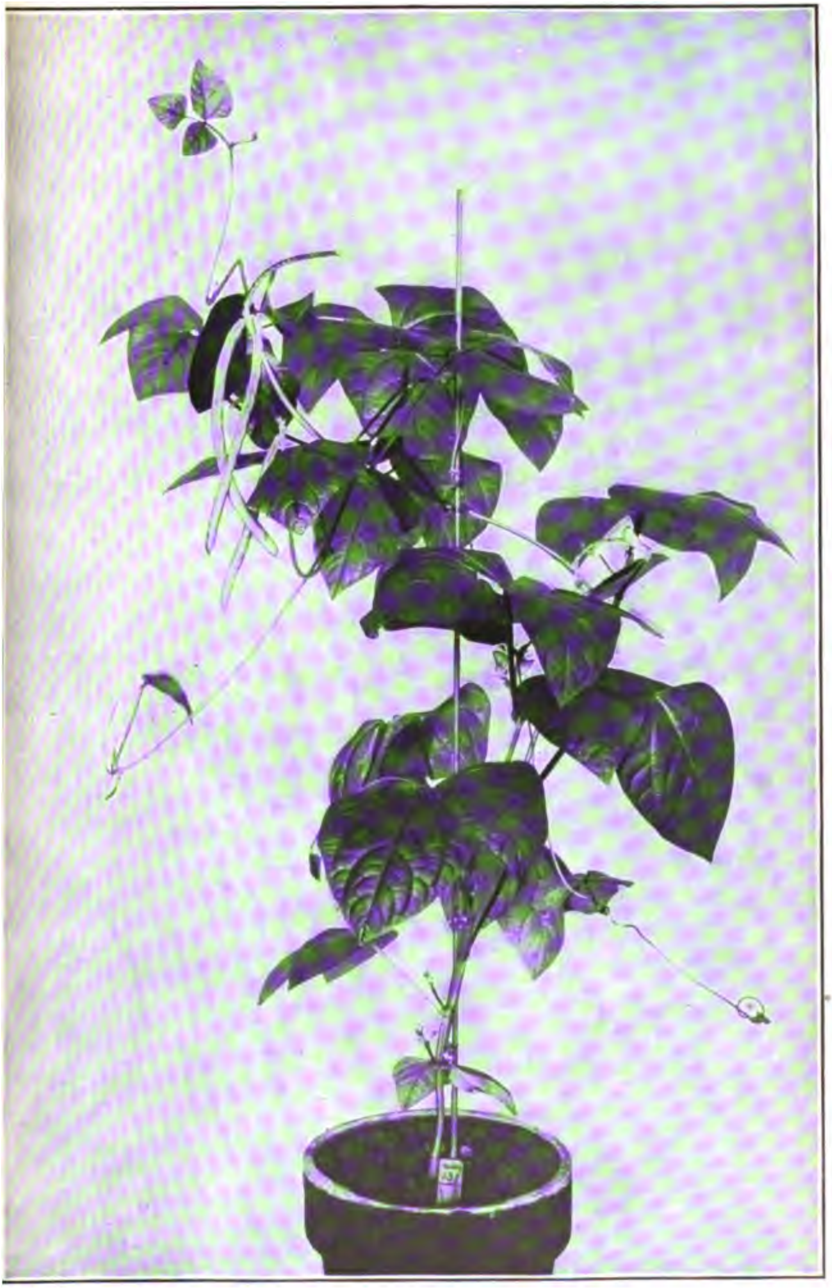
[a] The edition of this work published in 1536 was the one consulted.

Koernicke, 1885, Verhandlungen des naturhistorischen Vereins der preussichen Rheinlande, Westfalens und des Reg.-Bezirke Osnabrück, Correspondenzblatt, 136, maintains that the phaseolus of Dioscorides and the phaseolus cultivated in Italy before the discovery of America were the same species, "*Vigna sinensis*," and that the "Smilax kepaia" of Dioscorides was likewise that species, but a climbing form. Koernicke states that a work of the year 1415, by Rinio, a Venetian physician, contains a colored illustration of "Faseolus," and he identifies this as *Dolichos melanopthalmus* DC. He says also that in both Codices of Dioscorides of the fifth century after Christ, which illustrate the plant named phaseolus, the figures are likewise the low form of *Vigna unguiculata*, while for Smilax kepaia an illustration is wanting. Koernicke, however, believes *Dolichos melanopthalmus* DC., *D. monachalis* Brot., *D. lubia* Forsk., *D. sesquipedalis* L. to be low forms, and *D. catjang* L., D. *sinensis* Stickman, and *D. tranquebaricus* Jacq. to be climbing forms of the same species. Baker, 1879 (in Hook. Fl. Brit. India, 2:206), gives *V. sinensis* as the climbing and *V. catjang* as the low form. Koernicke says that the variation in the seeds is not greater than in *Phaseolus vulgaris*, and that dried plants in the Berlin Herbarium show no specific differences. *Vigna sinensis* (*Dolichos sinensis* Stickman) on the basis of priority is adopted by Koernicke as the correct name of the species, but he apparently overlooks the fact that *Dolichos unguiculatus* L. (*Vigna unguiculata* (L.) Walp.) is still earlier. Koernicke gives central Africa as the original habitat of the species. *Dolichos sesquipedalis*, the asparagus bean, is considered a distinct species by most authors, and the writer can not agree with Koernicke that all the other names apply to the same species or that central Africa is the home of any of them. It is true that the habit of growth, whether low or a climbing form, is of no specific value, for *Vigna unguiculata* at least seems to vary in this respect.

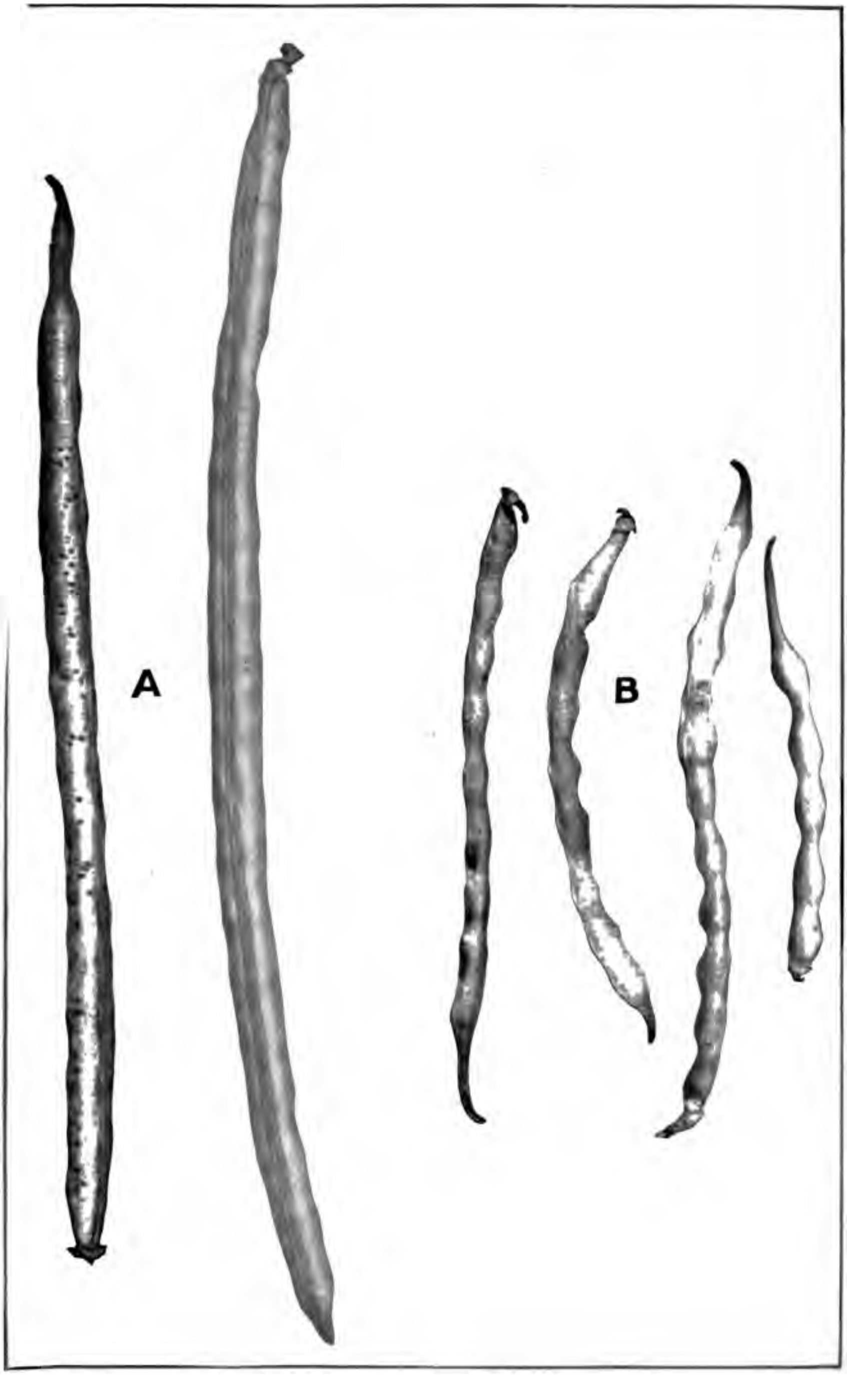
The color of the seeds likewise fails as a distinguishing specific character. *Dolichos unguiculatus* L. was founded on specimens grown in the garden at Upsala, but came to Linnæus from Barbados. *Dolichos sinensis* was based on *Dolichos sinensis* or *Katjang Sina* of Rumphius, and the figure in Rumphius Herbarium Amboinense shows a climbing plant with two-flowered racemes and pendulous pods. *Dolichos catjang* is likewise based on a species of Rumphius, *Phaseolus minor* or *katjang poeti*. The figures of this



PLANT OF VIGNA CATJANG (BURM.) WALP.



PLANT OF VIGNA UNGUICULATA (L.) WALP.



PODS OF COWPEAS.

A.—*Vigna unguiculata.* B.—*Vigna catjang.*

(Natural size.)

species shows a plant with the racemes two or three flowered, but with the pods at maturity smaller and erect, or nearly so, and with smaller seeds. A species grown in the greenhouses of the United States Department of Agriculture shows similar characters, the pods remaining erect until full grown, although they become pendent at maturity. The pods are also conspicuously torose at maturity. This species is *Vigna catjang* (Burm.) Walp. (Pl. I and Pl. III, B). Practically all of the varieties commonly cultivated in America belong to *Vigna unguiculata* (L.) Walp. (*V. sinensis* (Stickman) Endl.), the species with larger seeds and larger pods which usually become pendulous when half their mature size or sometimes even earlier, and which are only slightly constricted between the seeds (Pl. II, and Pl. III, A). Forskal, 1775 (Fl. Aegypt-Arab., 133), described *Dolichos lubia* as having peduncles racemosely spicate at the apex and the flowers crowded, and it may therefore be inferred that the racemes were several-flowered. The pods were described as erect. The color of the seeds is not mentioned by Forskal, but Delile, 1812 (Plant. Cult. en Egypt, 14), says they were white, with a black point at the eye. Koernicke says the " ring about the navel is pale red," and the seeds labeled *D. lubia*, recently received from the Muséum d'Histoire Naturelle, Paris, are quite small, red, with a black ring at the hilum. The varieties of *Vigna unguiculata* commonly cultivated in America seldom vary from the few-flowered character of the raceme and, at maturity, pendulous pods. Delile says *Dolichos lubia* is known also in Syria, Persia, and India, but there is but one other modern author who has applied the name to any species in Asia. Basiner, 1848 (Beitr. Russ. Reich., 15:233), gives *Dolichos lubia* as one of the forage plants of Khiva, where it was known as " Lobia " or " Lobi." No description is given, and therefore its identity with Forskal's plant is not certain.

The fact that Delile says it was found also in India, but does not mention any species of Vigna, suggests that his plant may have been *Vigna unguiculata* or *Vigna catjang*. Roxburgh, 1832 (Fl. Ind., 3: 302), described *Dolichos sinensis* as with peduncles " many-flowered," and *D. catjang*, few-flowered. Baker, 1879 (Hook. Fl. Brit. Ind., 2:206), unites the two as *V. catjang* and says peduncles 3 to 6 flowered. Baker, 1871 (Oliver, Fl. Trop. Afric., 2:204), describes the racemes of *Vigna sinensis* as 6 to 12 flowered and the pods pendulous. It appears, therefore that the few-flowered character of the raceme usually observed in varieties cultivated in America is not constant in either *Vigna unguiculata* or *Vigna catjang*. The descriptions cited above indicate a variation of from 3 to 12 in the number of flowers, and the plant described by Forskal as *Dolichos lubia*, since it had erect pods, is doubtless identical with *V. catjang*. Yet, notwithstanding the variation in habit and number of flowers in the raceme, the small seeds and small, erect pods of *Vigna catjang* appear to be constant characters, and two species, *Vigna unguiculata* (*V. sinensis*) and *V. catjang*, therefore are probably concerned in the descriptions of these plants by the above authors.

It is quite possible that *Vigna unguiculata* and *V. catjang* may have been grown by the Romans without being distinguished. The cultivation and even knowledge of them, however, appears to have been extremely limited in Europe, and *V. unguiculata* at least may have first reached central Europe not from Italy, but by way of Russia and Russian Turkestan.

In 1583 Clusius (Atrebatis Rar. Stirp., 725) described and figured a plant as a kind of phaseolus which is undoubtedly *Vigna unguiculata*, though pods are not shown in the figure. Seeds of this plant were received by Clusius at Vienna in the year 1576, having been sent by Dodoens from Prague, where it was grown in the garden of the castle the previous year. The following year, 1577, seeds of the same plant were also sent by the Spaniards to the Austrian Emperor. These statements are repeated by Clusius, 1601 (Hist. Rar. Pl., p. ccxxii), where the same figure, as in the previous work, is reversed and a figure of the pods in addition is given. It would appear from these records that *Vigna unguiculata* first became known to the botanists of central and northern Europe by its being grown at Prague.

If seeds had reached Prague from Italy, the plant would probably have been known also at Vienna, which was in the route of trade from Italy northward, and, since Prague is an inland city, the seeds may have been brought overland directly from Persia or India. So long as the Venetians were in control of the trade with India, Austria and southern Germany carried on commerce with Venice. With the acquisition of the Indian trade by the Portuguese, Venice could no longer supply the markets of Europe with the products of the East and European nations apparently soon became jealous of the advantages held by Portugal, for it is stated by Robertson, 1802 (Historical Disquisition Concerning India, 319), that an attempt was made, in order to diminish the advantages which the Portuguese derived from the discovery of a sea passage around the Cape of Good Hope, to induce the Russians to convey Indian and Chinese commodities through their Empire to some port on the Baltic from which they might be distributed through every part of Europe. This author also gives a brief account of the trade thus established. Yeats, 1872 (The Growth and Vicissitudes of Commerce, 155), states that Kazan was the chief entrepôt of the trade of northern and central Asia. Russian trade with other European nations appears to have been confined largely to the countries of the north and he cities belonging to the Hanseatic League. Very little seems to have been written concerning the commerce of Prague, but the Bohemians are a Slavic people and it is not improbable that they had some trade with the other Slavic peoples of Europe. At least no explanation of the occurrence of *Vigna unguiculata* at Prague before it was known at Vienna seems so plausible as that it came by one of the caravan routes to Russia and thence to Prague. De Candolle (Origin of Cultivated Plants, 39) says *Sium sisarum* "came perhaps from Siberia into Russia, and thence into Germany," and inclines to the view that it was not known to the ancient Greeks and Romans. This species is considered to be a native of the Altai region of Siberia and northern Persia. The caravan route from India and China to Russia passed through the latter region.

The figure in Rinio, 1415 (De Simplicibus), referred to by Koernicke, the writer has not seen, but in the Vienna Dioscorides Codex, dating from about the fifth century, the figure of the plant supposed to be the phasiolus of Dioscorides shows a several-flowered raceme. It also shows what appear to be mature pods and, while not strictly erect, they are not pendulous like those of *Vigna unguiculata.* The word "lubia" is written in Arabic on the parchment and the figure corresponds very closely with the description of *Dolichos lubia.* Forskal says the latter species was known among the Arabs as "*Lubia baeledi*" (common lubia). Dioscorides was probably born at Anazarba, a place in southeastern Asia Minor near the eastern extremity of the Mediterranean, but he is supposed to have traveled and it is not known where the plants he described may have been seen.

Koernicke believes the species to have come originally from central Africa, as it grows wild there. This, however, is not necessarily conclusive. There are other instances, especially in the Tropics, of plants appearing indigenous to countries in which they are known not to be native. The facts given by Koernicke indicate rather that the species has been introduced into central Africa, for he gives no name in the native language, but says it is known to the natives by the Arabian names "lubiah" and "ollaich." Seeds of this plant have never been found in the monuments of ancient Egypt, and the origin of the word "lubia" indicates that the plant to which it was applied came into Arabia and Egypt from the east. Lubia, lubiya, or lobiya probably was not derived from the Greek word λοβός, which primarily means any projection like the lobe of the ear, but appears to be of Persian origin and came to India through the Persians. Sir George Watt, 1890 (Dict. Econ. Prod. India, 3: 184), says: "No name like *lobiya* is given to any pulse by the aboriginal races of Indian or by those of Aryan origin. It occurs purely among the people of upper India, where Persian influence is most pronounced." The same author states that in all the districts of the northwest provinces, with but one possible exception, the word lobiya is applied to *Vigna catjang.*

Although none of the Indian works consulted that mention lubiya are of such ancient date as Dioscorides, they nevertheless indicate the antiquity of its cultivation in India. *Vigna catjang*, the species with erect pods, is described and figured in Rheede, 1688 (Hort. Malabar, 8:75. *t. 41*), under the name *paeru.* It is interesting to note that the root nodules were mentioned in this work, "The root is slender, whitish, and fibrous, the fibers clothed with round globules." Rheede described nine different preparations of the seed which were used in medicine. Other bean-like plants occur in the same work under the names *putsja-paeru* and *catu-paeru*, which indicates that the paeru was better and probably longer known than the plants to which compound names were given. In a work, Ain-i-Akbari or Ayeen Akbery (Institutes of the Emperor Akbar), written in Persian during the reign of the Emperor Akbar, 1556–1605, describing the crops grown in Delhi and Agra, translated by Francis Gladwin, 1783. 1:87, "lubya" is given as one of the crops of the autumnal harvest. Sir George Watt states that at the present time this would be *Vigna catjang*, and in all probability would have been the same in Akbar's time. Sir George Watt gives nearly 50 vernacular names in different Indian languages, of which only four are compound words and only four others consist of more than one word. One of the Sanskrit names given by Watt is *nishpáva.* In the Vishnu Purana, lib. 1, cap. 6, supposed to date from about 1045 A. D. (translation by Horace Wilson, Complete Works, 6:95), "Nishpáva, a sort of pulse," is mentioned in the list of important grains. This work is five hundred years later than the illustration in the Vienna Dioscorides Codex. Nevertheless, Sanskrit for two thousand years or more has led an artificial existence, being the means of communication and literary expression of the priestly and learned castes, and the writer finds no indication that the name nishpáva has ever been applied to any other plant.

The species appear to be probably of less ancient cultivation in China, for there is no indication of a Chinese introduction into India or Persia, and it is improbable that the same species would be native on both sides of such a natural barrier as the Himalayas. Nevertheless, *Vigna unguiculata* at least appears to have been long cultivated in China. It is mentioned and illustrated in the second edition of the Kiu Huang Pen Ts'ao, which appeared in 1559. In this work it is called the "common bean," and other beans are compared with it. It has not been practicable to consult the first edition of this work, pubished in the beginning of the fifteenth century, and whether it appears there or not is uncertain.

It may be noted that no plant of American origin has been identified in any Chinese work previous to the Pen Ts'ao Kang Mu, which was finished in 1578, though not published until after 1596.

It may be concluded from the facts so far known regarding these species that both *Vigna unguiculata* and *V. catjang* originally came from a region including and extending from India to Persia and the southern part of the Trans-Caspian district, and that the Persians called one or both of them by the name "lubia" and applied that name to *V. unguiculata* in northwest India after their conquest of that region. The cultivation of *V. unguiculata* extended to China at a very early date, but the distribution of at least one of the species with the name "lubia" had extended from the region of its origin at the beginning of the Christian era to Arabia and Asia Minor and had reached some of the Mediterranean countries of Europe at about the same time, but did not become known in central Europe until the middle of the sixteenth century.

P. I.—287.

A NEW METHOD FOR THE DETERMINATION OF NICOTINE IN TOBACCO.[a]

By WIGHTMAN W. GARNER, *Scientific Assistant, Tobacco Breeding Investigations.*

THE RELATION OF NICOTINE TO THE QUALITY OF TOBACCO.

Nicotine is the characteristic alkaloid of tobacco, and thus far as not been found in any other plant. Its function in the economy f the plant is not understood, and it has not been determined with ertainty whether it plays a rôle in nutrition or is simply a waste roduct resulting from katabolic changes in the albuminoid constitunts. The physiological effects on the human system resulting from he use of tobacco are doubtless due chiefly to the presence of nicoine, though in the case of tobacco used for smoking purposes other onstituents of the smoke probably play a considerable part. On he other hand, it has been repeatedly shown that the burn, flavor, roma, and other important qualities of tobacco are in no sense proportional to the amount of nicotine present. Indeed, even the "strength" of manufactured tobacco—using this term in the sense understood by the trade—is not dependent upon the nicotine content. It seems only reasonable, however, to suppose that tobacco entirely free from nicotine would no longer prove satisfying to the consumer any more than would whisky deprived of all its alcohol.

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[a] In the Tobacco Breeding Investigations conducted by the Bureau of Plant ndustry careful experiments have been undertaken to determine the relation f the nicotine content of cigar filler and wrapper tobaccos to the quality of hese tobaccos. It has been found in the preliminary experiments carried out y Dr. W. W. Garner, of this office, that the nicotine content of the leaves of ifferent tobacco plants grown under the same conditions varies in a striking anner. The variability of the nicotine content of individual plants has sugested the possibility of securing, by breeding and seed selection, strains of the ifferent varieties of cigar wrapper and filler tobaccos possessing a low or a igh nicotine content. The large number of nicotine determinations necessary n the carrying out of these tests has required a great expenditure of time and oney owing to the complicated and expensive method of determination. The ew method of determining the nicotine content of tobacco described in this ulletin greatly simplifies the work of the experimenter by enabling him to make any more determinations in the same length of time than by any previous ethod. This method also is very much less expensive than any previous ethod and, as shown in this bulletin, is more satisfactory from the standoint of accuracy and reliability. The relation of the nicotine content of obacco to the quality and other characteristics of tobacco and the possibility of reeding tobacco low or high in nicotine content will be presented in more etailed future reports of the Department.—A. D. SHAMEL, *Physiologist in harge of Cotton and Tobacco Breeding Investigations.*

Numerous attempts have been made to devise a process for the partial removal of the nicotine from tobacco, either before or after it is manufactured, by appropriate treatment, and many patents have been issued for processes intended to accomplish this result, but none of the proposed methods has as yet proved sufficiently practicable to come into general use, and this is not surprising when it is remembered that the flavor and aroma of tobacco are comparable in delicacy to those of tea and coffee and that consequently even the mildest treatment for the removal of the alkaloid is almost certain to result in injury to these qualities.

There can be no doubt that there would be a genuine demand for tobacco containing only a very small percentage of nicotine but retaining the other attributes of the best grades of the crop as now produced, especially in the case of the cigar-filler types. The most rational method of attaining this end would seem to lie in the systematic breeding of types characterized by their low nicotine content, and at the same time avoiding those soils, fertilizers, and cultural methods which tend to the excessive production of the nitrogenous constituents of the plant. Extensive experiments have been undertaken in connection with the Tobacco Breeding Investigations of the Bureau of Plant Industry with the object of securing types of tobacco of this kind, and the results already obtained tend to show that the variation in nicotine content of individual selections from various types is fully as great as that of such physical characteristics as shape, size, and number of leaves. Since nothing like sufficient data are available for establishing any constant relation between the physical characteristics of different tobacco plants and their nicotine content, these experiments necessitate the accurate determination by analysis of the quantity of the latter in a very large number of selected plants.

THE QUANTITATIVE DETERMINATION OF NICOTINE IN TOBACCO.

In order to conduct these experiments on a sufficiently comprehensive scale it is imperative that there be available a method for the estimation of nicotine which is reasonably accurate and is at the same time rapid, so that a large number of determinations may be completed in a day's work. Kissling[a] has developed a method which seems to have given satisfactory results in the hands of most analysts, and has come to be recognized as the standard process. But this method is long and tedious, and hence is not adapted to our needs. It consists essentially in moistening the powdered sample with aqueous caustic soda and extracting with ether for several hours in a suitable form of continuous extraction apparatus. The ether is carefully distilled from the extract, and the residue is subjected to distillation with steam. The distillate is collected in 100 c. c. portions and titrated with a standard acid. It is apparent that the process is an expensive one, both in point of materials consumed and necessary equipment and in the time required for carrying it out.

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[a] Zeitschr. Analyt. Chem., XXII, 199.

Keller[a] has described a method which is simple and rapid in execution and avoids the tedious process of distilling the extracted nicotine with steam. Six grams of the tobacco, previously dried over lime, are placed in a cylinder with 60 grams of ordinary ether and 60 grams of petroleum ether, and 10 c. c. of 20 per cent aqueous caustic potash are added. The contents of the cylinder are vigorously shaken for thirty minutes and then allowed to stand for three hours to clarify. The extract is filtered and 100 grams of it placed in a cylinder. To remove the ammonia in solution, a rapid current of air is blown through the extract, after which there are added 10 c. c. of water. After shaking well, an excess of standardized hydrochloric acid is added and the titration completed with standardized ammonia. With some minor modifications the method gives fair approximations, but we have found that it is unsuited to our requirements. In point of materials consumed it is even more expensive than the Kissling process, and it also contains several sources of error. Adding 10 c. c. of aqueous potash to the ether mixture increases the total weight of solvent more than 8 per cent, and considerable quantities of nicotine remain in the aqueous portion. Ordinary ether boils at 36° C., which is but little above ordinary room temperatures, and consequently it is quite impossible to filter the extract without very considerable loss of the solvent by evaporation. Again, most tobaccos yield extracts which are so deeply colored that the nicotine can not be titrated with accuracy until the solvent has been removed. This is the principal reason why it is necessary to subject the extract obtained by the Kissling process to distillation with steam. From the results of our experiments with Keller's method, supplemented by further tests along other lines, we have developed a process which differs essentially from Keller's in all of the details of the operation and obviates the difficulties encountered in the latter.

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[a] Ber. Pharm. Gesell., 1898, 145.

Nicotine is readily soluble in nearly all of the ordinary solvents, and hence there is no difficulty in extracting it completely from tobacco after it has been liberated from its salts by means of a fixed alkali. The separation of the nicotine from ammonia and amid bodies, which are always present in tobacco, is the principal problem to be solved in this connection. By using such solvents as ether and ligroin, however, only the nicotine and a portion of the ammonia are contained in the extract, and it is possible to remove subsequently practically all of the ammonia by appropriate methods.

THE PROPOSED NEW METHOD.

In endeavoring to devise a method for estimating nicotine suited to our requirements, three principal objects were kept in mind, namely, the use of a comparatively cheap solvent, the extraction of the nicotine without the use of an extraction apparatus requiring the application of heat, and the direct titration of the extract without previous distillation. Our process as finally adopted accomplishes all of these ends, as will appear below.

Gasoline or ligroin was chosen as the most suitable solvent. This is prepared by shaking the crude gasoline of 70° with concentrated sulphuric acid and distilling and collecting the distillate coming over between the limits of 60° and 100° C. By using a product with high boiling point, the evaporation which takes place during the filtration of the extract is reduced to a minimum and there is little danger of explosions occurring from the accumulation of the vapors in the atmosphere of the room. A number of preliminary experiments were carried out to determine the conditions necessary for the complete extraction of the nicotine from the tobacco and the effect of varying amounts of ammonia on the results obtained by titration of the extracts.

PRELIMINARY EXPERIMENTS.

In order to avoid the possibility of the presence of organic acids in the extract and to insure the complete extraction of the nicotine, a fixed alkali must be added, and this is best applied in aqueous solution. Gasoline and water are immiscible and their mutual solubility is very slight, but these facts do not in any way hinder or retard the extraction of the nicotine, since the latter is easily soluble in both the water and the gasoline.

It is necessary to agitate the mixture only occasionally to avoid too great a concentration of the nicotine in the portion of either solvent which happens to be in direct contact with the tobacco. Using the ligroin in quantities of 100 c. c. to 6 or 8 grams or less of tobacco, it was found that the extraction of the nicotine is complete at the end of four hours, and when the quantity of the latter in he tobacco is small less time is required. Ligroin is capable of lissolving only a very small quantity of ammonia gas, and even this s rapidly given off when the solution is exposed to the air, and specially when it is also agitated. It was found by experiment that .00 c. c. of ligroin saturated with ammonia, after being allowed to tand one hour in an unstoppered Erlenmeyer flask, retained less han 5 milligrams of this base. On the other hand we have found hat no loss of nicotine whatever occurs when a solution of 0.3 gram f the base in 100 c. c. of ligroin—equivalent to 5 per cent nicotine n 6 grams of tobacco—is allowed to stand several hours in an open eaker at ordinary room temperature. Tobacco, especially after it as been fermented, contains considerable quantities of ammonia, ut it was found that only a small proportion of this is contained in he extract; hence the quantity dissolved is not sensibly affected by he varying amounts contained in different samples of tobacco.

This fact is of importance, because it renders the subsequent emoval of the ammonia a very simple matter; in fact, even if no ttempt is made to remove the ammonia in solution the error resulting therefrom will not exceed 0.2 per cent. In the following table he results given in percentages in column 1 were obtained without he previous addition of ammonia, while those in column 2 were btained from the same samples after the addition of quantities f ammonia in aqueous solution corresponding to 1.4 and 3.5 per cent, espectively, for 6 grams of tobacco:

Field number of tobacco samples.	1 Nicotine.	2 Nicotine.
	Per cent.	*Per cent.*
3-2-3	3.51	3.53
-20-2	3.04	3.05

A fair idea of the ammonia actually dissolved by the gasoline is given by the results shown in the following table. The percentages n column 1 were obtained by direct titration of the extracts, while n the case of the first two experiments, the results of which appear in olumn 2, a current of air was drawn through the extract for five ninutes before titrating, and in the last three experiments the soluions were allowed to stand an hour in unstoppered Erlenmeyer flasks efore making the titrations.

Field number of tobacco samples.	1 Nicotine.	2 Nicotine.
	Per cent.	*Per cent.*
3-2-3	3.53	3.46
-20-2	3.09	3.04
23a-1-4	1.92	1.82
23a-1-2	1.86	1.76
-20-5-12	1.53	1.72

Finally, a number of analyses of different samples were made in duplicate to show that the proposed method gives concordant results even when some of the conditions are somewhat modified, as, for example, when the volume of aqueous caustic soda added to the tobacco before extraction is varied. The tabulated results follow:

Field number of tobacco samples.	1 Nicotine.	2 Nicotine.
	Per cent.	*Per cent.*
75-124, 222	4.90	4.[illegible]
75-124, 202	3.92	3.[illegible]
125a-1-2	2.00	2.[illegible]
123a-1-1	1.95	1.[illegible]
123a-1-3	1.88	1.[illegible]

DESCRIPTION OF THE METHOD.

From these preliminary data we have been able to work out the details of a very simple method for the quantitative estimation of nicotine which is both rapid and accurate and requires nothing but the simplest forms of apparatus and inexpensive materials.

The air-dried sample is pulverized by passing through a sieve containing twenty or more wires to the inch. For exact work the water content is determined by drying over sulphuric acid for forty-eight hours 1 gram of the sample on a large watch glass placed in a desiccator, while for approximate results the air-dried sample may be assumed to contain 5 per cent of water. Six grams of the pulverized sample are weighed into a beaker, from 3 c. c. to 5 c. c. of 5 per cent aqueous caustic soda solution are added, and the mixture is stirred with a steel spatula until homogeneous. The quantity of caustic soda solution to be used depends on the character of the tobacco to be analyzed; thin, light-bodied samples, such as cigar-wrapper tobaccos, require a larger amount of the solution than do thick, heavy samples, such as domestic cigar-filler types.

The moistened sample is next transferred to a 200 c. c. glass cylinder and 100 c. c. of the ligroin are added. The cylinder is tightly stoppered and the contents thoroughly agitated for a few minutes, after which the cylinder is placed in a horizontal position. This insures the exposure of a maximum amount of surface of the tobacco to the solvent action of the ligroin. Stout glass tubing of suitable diameter and length, sealed at one end and fitted with a good soft cork, serves equally as well as the cylinder for the extraction. After four hours, during which time the contents of the cylinder should be thoroughly agitated at intervals of about thirty minutes, the latter is placed in an upright position in order to allow the upper portion of the gasoline to clarify. After thirty minutes or longer the extract is passed through a folded filter, care being taken to first moisten the filter with the clear portion of the gasoline. The extract is poured off from the tobacco without bringing the latter on the filter, and further portions are pressed out by means of a glass rod flattened at one end. The filtration should be carried out as rapidly as possible in order to avoid loss from evaporation, and as soon as all the extract can be brought on the filter the funnel should be covered with a watch glass. An aliquot portion of the filtrate—conveniently 75 c. c., corresponding to 4.5 grams of tobacco—is measured into a dry separatory funnel, which is left unstoppered and allowed to stand for about an hour in order to remove the ammonia. As has already been stated, no loss of nicotine is to be feared by this treatment. Instead of allowing the extract to stand in the funnel a slow current of air may be drawn through it for five minutes by means of a stopper supplied with inlet and outlet tubes, the latter of which is connected with a filter pump. After the ammonia has been removed 10 c. c. of fifth-normal sulphuric acid in about 50 c. c. of water are introduced into the funnel and the contents thoroughly shaken. After drawing off the aqueous layer the gasoline is washed twice with small volumes of water and the excess of sulphuric acid titrated with tenth-normal alkali, using cochineal as the indicator.

This method of titrating the nicotine may be modified as follows: The measured portion of the filtered extract is placed in a 250 c. c. Erlenmeyer flask and allowed to stand an hour. The standard acid is then run in and a convenient volume of water added. The contents of the flask are thoroughly shaken, and after the two layers have separated the greater portion of the ligroin is drawn off by means of a pipette.[a] The excess of acid is then titrated as before. One cubic centimeter of fifth-normal sulphuric acid is equivalent to 0.0324 gram of nicotine.

COMPARISON OF THE NEW METHOD WITH THAT OF KISSLING.

As has already been stated, the only reliable method for the determination of nicotine heretofore available is that of Kissling, and we have used this as the standard for comparison. The nicotine content of a large number of samples of tobacco of different types has been determined both by the Kissling process and by the new method, and the figures given in the following table are fairly representative of the results obtained.

It will be seen that the nicotine content in the different samples included in the table varies from 5 to less than 1 per cent, and these samples represent practically all classes of domestic cigar tobacco of both wrapper and filler types. Most of the samples had been fermented, but some of them were unfermented. All results are calculated on the water-free samples.

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[a] It is necessary to remove the greater portion of the gasoline before titrating because of the yellow coloring matter which it contains in solution.

Field number of tobacco samples.	Kissling method.	New method.	Difference.
	Per cent.	*Per cent.*	*Per cent.*
75-154, 242	5.03	5.02	–0.01
75-154, 218	4.70	4.61	– .09
13-2-3	3.66	3.57	– .09
3-20-2	3.18	3.09	– .09
125b-1-4	2.60	2.59	– .01
123a-1-12	2.37	2.27	– .10
124b-1-1	2.19	2.11	– .08
123a-1-11	2.15	2.08	– .07
125a-1-2	2.19	2.03	– .16
123a-1-1	2.00	1.92	– .08
125b-1-1	1.92	1.95	+ .03
123a-1-8	1.97	1.88	– .09
123a-1-3	1.96	1.87	– .09
123a-1-2	1.72	1.76	+ .04
123a-1-9	1.64	1.77	+ .13
125a-1-4	1.64	1.57	– .07
3-20-5-12	1.52	1.53	+ .01
124b-1-6	1.58	1.49	– .09
3-20-5-6	1.32	1.40	+ .08
109-3-4	.89	.94	– .05

Average difference, 0.04 per cent.

CONCLUSION.

It will be observed that the results shown in the above table indicate that the new method gives figures averaging a few hundredths per cent lower than the Kissling method. This difference is due to the water added to the sample along with the caustic soda, which is not taken into account in the calculations. From 3 to 5 c. c. of water are thus added, depending upon the character of the tobacco. As is well known, tobacco is markedly hygroscopic, and a considerable portion of the added water is doubtless held in loose chemical combination with the salts contained in the tobacco, and hence does not act as a solvent for the nicotine. The portion of the water not thus combined, however, really forms a part of the nicotine extract. It was found by experiment that the relative solubility of nicotine in ligroin and in water is in the ratio of 11 to 9. The mutual solubilities of ligroin and water are so slight as to be negligible, and there is no appreciable contraction in volume when the two are mixed. Taking all the facts into consideration, it is clear that the actual error resulting from the addition of the water to the sample to be analyzed is too small and variable to attempt any correction therefor.

It should be observed in this connection that those types which contain the highest percentage of nicotine belong to the class of heavy filler tobaccos, and hence require the addition of only the smallest quantity of water. This, of course, tends to equalize this source of error. The analyses by the Kissling method were not made in duplicate, and differences in the results obtained by the two methods amounting to one-tenth of 1 per cent or more are doubtless due to slight experimental errors.

After a very careful test of our new process, we are fully convinced that it gives very reliable and accurate results, while it is so simple in execution that there are few chances for the occurrence of errors in manipulation.

THE PHILADELPHIA
DEC 20 1907
MUSEUMS

INDEX.

Page.
Alfalfa, vegetative propagation, *paper* ... 33–37
Application of vegetative propagation to leguminous forage plants, *paper* ... 33–37
Beans, history from earliest times ... 44–59
Breeding plants by cuttings ... 35–37
Butter produced on successful dairy farm ... 23
Cacti, ash content ... 9–10
    balanced ration ... 12–13
    chemical analyses ... 8
        composition, table ... 18
    common and scientific names ... 15
    climatic requirements of prickly pears ... 16–17
    fed with other foods ... 12–13
    food value of different parts of plant ... 11–12
    species studied ... 17–18
    use of prickly pears in Mexico ... 17
    value as stock food, *paper* ... 7–18
        of different groups ... 14
    water content ... 8–9
Control of Texas root-rot of cotton, *paper* ... 39–42
Cotton, Texas root-rot, benefit of crop rotation ... 40
        cause ... 40
        control, *paper* ... 39–42
        effect of deep fall plowing ... 40
            spring plowing and subsoiling ... 41
        efforts to prevent or control ... 40
        importance of aeration of soil ... 40–41
        treatment recommended ... 41–42
Cowpea, history and introduction into America, *paper* ... 43–59
Cows and calves, feed ... 22
Cropping system, plans for farms, *paper* ... 25–31
Crop rotation on dairy farms ... 20–21
        recommended and adopted on Illinois farm ... 29–31
Cuttings, method of propagation ... 34–35
Dairy farm, successful, *paper* ... 19–23
        receipts and expenses ... 23
Determination of nicotine in tobacco, new method, *paper* ... 61–69
Disease, Texas root-rot of cotton, control, *paper* ... 39–42
DODGE, LAWRENCE GREEN, paper entitled "A successful dairy farm" ... 19–23
Farm cropping system, *paper* ... 25–31
    dairy, successful, *paper* ... 19–23

Page
Farm, hog, system of management 25-28
    in Illinois for which a cropping system was recommended 27-31
Feed for cows and calves 22
    stock of different kinds 27-31
        value of cacti 7-18
Forage plants, leguminous, vegetative propagation, *paper* 33-37
GARNER, WIGHTMAN WELLS, paper entitled "A new method for the determination of nicotine in tobacco" 61-69
GRIFFITHS, DAVID, and HARE, R. F., paper entitled "Summary of recent investigations of the value of cacti as stock food" 7-18
HARE, R. F., and GRIFFITHS, DAVID, paper entitled "Summary of recent investigations of the value of cacti as stock food" 7-18
Harvesting hay on dairy farm 21-22
Hay harvesting on dairy farm, method 21-22
History of the cowpea and its introduction into America, *paper* 43-59
Illinois farm for which a cropping system was recommended 27-31
Inbreeding of plants, effect 37
Kissling's method for determination of nicotine in tobacco, comparison with new method 67-68
Legumes, propagation by cuttings, *paper* 33-37
MILES, GEORGE FREEMAN, and SHEAR, CORNELIUS LOTT, paper entitled "The control of Texas root-rot of cotton" 39-42
New method for the determination of nicotine in tobacco, *paper* 61-69
New York dairy farm, successful, *paper* 19-23
Nicotine in tobacco, comparison of new method with that of Kissling 67-68
        description of new method of determination 66-67
        experiments to determine 64-66
        new method of determination, *paper* 61-69
        proposed new method of determination 64-67
        quantitative determination 62-64
        results secured by new method of determination 68-69
    relation to quality of tobacco 61-63
OLIVER, GEORGE WATSON, and WESTGATE, JOHN MINTON, paper entitled "The application of vegetative propagation to leguminous forage plants" 33-37
Opuntia spp. *See* Cacti.
Pasture for stock, area required 27-31
Pear, prickly. *See* Cacti.
Peas, history from earliest times 44-59
Planning a cropping system, *paper* 25-31
Plants, breeding by cuttings, advantages 35-37
    inbreeding, effect 37
    leguminous forage, vegetative propagation, *paper* 33-37
    method of propagation by cuttings 34-35
    self-fertile, list 36
    self-sterile, list 36
Poultry produced on successful dairy farm 23
Profits of successful dairy farm 23
Propagation, vegetative, for leguminous forage plants, *paper* 33-37
        method employed with leguminous plants 34-35
Receipts on successful dairy farm 23
Root-rot of cotton, control, *paper* 39-42

Page.
Rotation followed on successful dairy farm 20-21
  recommended for Illinois farm 29-31
Self-fertility of plants 36
  pollination, variability of legumes 37
  sterility of plants 36
Shear, Cornelius Lott, and Miles, George Freeman, paper entitled "The control of Texas root-rot of cotton" 39-42
Spillman, William Jasper, paper entitled "Planning a cropping system" .. 25-31
Stock food, value of cacti, *paper* 7-18
Successful dairy farm, *paper* 19-23
Summary of recent investigations of the value of cacti as stock food, *paper* ... 7-18
Texas root-rot of cotton, control, *paper* 39-42
Tobacco, new method for determination of nicotine content, *paper* 61-69
  relation to quality of nicotine content 61-62
Value of cacti as stock food, *paper* 7-18
Vegetative propagation for leguminous forage plants, *paper* 33-37
Vigna unguiculata, history, *paper* 43-59
Washington, George, use of cowpeas, etc 51-52
Westgate, John Minton, and Oliver, George Watson, paper entitled "The application of vegetative propagation to leguminous forage plants" 33-37
Wight, William F., paper entitled "The history of the cowpea and its introduction into America 43-59

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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 103.

B. T. GALLOWAY, *Chief of Bureau.*

THE PHILADELPHIA MUSEUMS
JUL 13 1907

DRY FARMING IN THE GREAT BASIN.

BY

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AGRICULTURIST IN CHARGE OF WESTERN AGRICULTURAL EXTENSION INVESTIGATIONS.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., March 6, 1907.

Sir: I have the honor to transmit herewith and to recommend for publication as Bulletin No. 103 of the series of this Bureau, the accompanying manuscript, entitled " Dry Farming in the Great Basin," by C. S. Scofield, Agriculturist in Charge of Western Agricultural Extension Investigations.

Nearly one-third of the arable land of the United States is either arid or semiarid, and consequently can be used for agriculture only when irrigated or when devoted to such crops as are able to thrive with a limited supply of moisture or such as permit special tillage by which the scanty rainfall may be secured and held in the soil.

Notwithstanding the natural drawbacks of this great semiarid region, which occupies the larger part of the western United States, hardy pioneers have found within it many places where profitable farming is possible, and they have worked out tillage methods and found suitable crops for some sections that were believed a quarter of a century ago to be unfit for anything but stock ranges.

In the present paper Mr. Scofield describes the natural conditions and discusses the farming methods and the crops for one of the sections of this arid region where " dry farming " is now successfully carried on. Some of the more important factors that have made this development possible are shown to be a distribution of the rainfall which is favorable as to season, a clean summer fallow between crops to conserve the rainfall of two seasons where necessary to produce a crop, and the maintenance of soil fertility by good tillage, ogether with the continued addition of organic matter to the soil. It is shown, also, that while something has been done in the way of sing drought-resisting crops, secured either through introducions from other countries or by plant breeding, much still remains o be done in this direction, and that further work along this line, ogether with still more knowledge as to the efficiency and cost of arious tillage methods, promises to greatly extend the boundaries of profitable agriculture in the arid West.

Respectfully,

B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

ILLUSTRATIONS.

PLATES.

Page.

PLATE I. Fig. 1.—General view of the San Juan County Arid Farm, Utah. Fig. 2.—Field of wheat in shock on land adjacent to the San Juan County Arid Farm 40
II. Fig. 1.—Field showing the type of summer fallow maintained in every other series on the San Juan County Arid Farm. Fig. 2.—The interior of an alfalfa plat on the San Juan County Arid Farm 40
III. Fig. 1.—A poor crop of wheat on the Sevier County Arid Farm, Utah. Fig. 2.—A crop of wheat grown without irrigation in the Cache Valley, Utah 40
IV. Fig. 1.—Harvesting wheat grown without irrigation, near Nephi, Utah. Fig. 2.—A hillside garden in a semiarid region, showing one of the settling ditches used to catch and hold the water which runs off the hill above 40

TEXT FIGURES.

FIG. 1. Map showing the location of the Great Basin 10
2. Sketch map of Utah, showing the irrigated areas according to the census of 1900 and the location of arid experiment farms 14
3. Diagrams showing the average monthly precipitation at some representative points in the semiarid West 18
4. Diagram showing the total annual precipitation at Logan, Utah, 1893–1906 19
5. Diagram showing the total annual precipitation at Tooele, Utah, 1897–1906 20
6. Diagram showing the total annual precipitation at Levan, Utah, 1890–1906 21
7. Diagram showing the total annual precipitation at Parowan, Utah, 1891–1906 22
8. Profile sketch showing the relative positions of Deseret, Fillmore, and Richfield, Utah 23

B. P. I.—266.

DRY FARMING IN THE GREAT BASIN.

INTRODUCTION.

During the past four or five years much interest has been manifested by the people of this country in the possibility of utilizing for agriculture some of the arable land in the western United States where the rainfall is insufficient for ordinary farming. There are several conditions that have contributed to this interest. American agriculture has enjoyed a large measure of prosperity during recent years and agricultural investment and farm-home development have received an unusual impetus. The choicest of the well-watered public lands have passed into private ownership and have greatly advanced in price.

Then, also, during the last two or three years there has been rather more than the normal amount of rainfall over the larger part of the arid region, and many people acquainted only with the present conditions firmly believe that the climate is gradually becoming more humid. This belief is probably without any foundation in fact, and it is surprising that it should exist, for the precipitation records of the whole country receive wide publicity; but since the idea is generally held and has been widely advertised it becomes important to emphasize the fact that there is no adequate basis for hoping that the climate of the arid West is undergoing any appreciable change as regards precipitation.

Within recent years, also, investigation and experimentation have been directed toward the solution of some of the complicated problems nvolved in the conservation of soil moisture in these arid regions. Actual additions to existing knowledge of the subject have been relatively few, but public attention has been directed to the work to uch an extent that the idea prevails that much more is now possible in he way of utilizing a limited rainfall than was ever possible before. There is some foundation for such a conclusion, but nothing to warrant many of the exaggerated statements now current. The conquest of the arid West, to be successful and to be accomplished without arge and costly failures, must be made slowly and by the careful application of definitely ascertained facts. The boundaries of existing settlements may be gradually extended, but any wholesale attempt to colonize large areas of this arid land with people accustomed to farming only in humid regions or not accustomed to farming at all is almost certain to result in disastrous failure.

The region just east of the Rocky Mountains has already been the scene of some large booms in arid lands. One of the first of these, which occurred from 1880 to 1885, was partly the result of a series of years of relatively high precipitation and partly the result of very extensive railroad building. A series of drier years following drove back many of the new settlers after they had lost all their possessions while waiting for a rainy season to come again. There have since been a number of smaller booms, which have affected different parts of the region at different times, as a result of temporary periods of increased rainfall or some other local cause. One of these, in the two or three years following 1890, began to assume large proportions when the financial crisis of 1893 and the severe drought of 1894 combined to drive back most of the new settlers. As each of these early waves of settlement receded, it left behind some few pioneers, who, by dint of harder work, by the use of better judgment in selecting land, or by turning to stock raising and using as range land the farms of their less persistent neighbors, succeeded in holding out through the dry years.

The region just west of the Rocky Mountains, particularly that portion of it lying within the State of Utah, was first settled by farmers who depended exclusively upon irrigation for crop production. The extensions of their settlements were naturally made along those streams from which the diversion of water for irrigation was possible. These first settlements were made about 1850, and for the next thirty years irrigation farming and stock raising on the open range constituted the only agriculture of the region.

In the decade of 1870–1880, some pioneer attempts were made to grow crops without irrigation in and around some of the valleys of the Great Basin. These attempts finally showed the way to the utilization of large tracts of fertile land for which no irrigation water could be had. The first efforts were relatively few and unimportant, but as the country became more thickly settled and new irrigation enterprises became scarce and expensive more attention was directed to the development of these nonirrigable lands.

This development was begun by growing crops to supplement those grown on the irrigated land. Almost no attempts were made at first to establish farms on the dry lands, so that the first failures, by which the methods of success were learned, were not so disastrous as they might have been had it been necessary to build homes and make other improvements independent of any irrigation opportunities. It is anifestly much easier to experiment in dry farming, to gamble on e weather as it were, if one has an irrigated farm to fall back upon adverse seasons. Even where it is possible by the use of windmills the development of springs or small streams to irrigate relatively nall fields during a protracted drought, the settler is able to tide er times when without such a resource complete failure would be evitable. When the utilization of the dry lands can proceed from ell-established agricultural centers, such as irrigated sections, in-ead of having to start unsupported in the midst of the dry lands, e risk of disastrous failure is greatly reduced.

From the modest and tentative beginnings of a third of a century go there has grown a well-established system of farming in some ctions of the country west of the Rocky Mountains. There are in is great intermountain area three fairly well defined regions in hich dry farming[a] is now practiced to a considerable extent. For nvenience of designation, these regions may be named the Great asin, the Columbia River Valley, and the interior valley of Cali-rnia. Each of these areas includes localities with widely differing nditions of soil, climate, and agriculture, and each, taken as a whole, iffers from the others in important particulars, yet they have some nportant features in common not shared by the Great Plains region, hich includes most of the arid lands east of the Rocky Mountains.

LOCATION AND GENERAL DESCRIPTION OF THE REGION.

The agricultural region referred to as the Great Basin area (fig. 1) ccupies a portion of the great depression between the Rocky Moun-ins and the Sierra Nevada. To the north of the Great Basin es the drainage basin of the Columbia River, while to the southward e drainage is collected by the Colorado River. The Great Basin roper is well defined topographically. It includes a large irregular ody of land lying chiefly in the States of Utah, Nevada, Oregon, and alifornia, of which the drainage finds no outlet to the ocean, but stead collects in various lakes and sinks, from which it evaporates.

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[a] The term "dry farming" is a recent addition to agricultural literature, but nce it meets a real need it will probably find a permanent place. There is some ifference of opinion as to just what the expression means. It is ordinarily nderstood to mean farming in an arid or semiarid region without irrigation, ut this is often confusing, since "arid" is at best a relative expression and rigation is often used even in humid regions. All good farming involves at ast some tillage of the soil, which accomplishes several purposes at once. The il is aërated, weeds are killed, the tilth is improved, and moisture is conserved. ometimes one and sometimes another of these objects is the chief aim, and ometimes all are important. In dry farming, however, the one object of para-ount importance is the conservation of soil moisture, and all the tillage opera-ons are directed to this end.

The Great Salt Lake of Utah and a large depression in Nevada, formerly occupied by Lake Lahontan, are the two most important drainage centers, but there are numerous smaller lakes and sinks quite independent of these. In addition to the agricultural land in the Great Basin proper there is a considerable area of arable land lying between the eastern side of the Great Basin and the Rocky Mountains. This constitutes the northern portion of the Colorado River drainage basin, but in view of the similarity of conditions prevailing over this region and the near-by Great Basin it seems proper to include both in a discussion of the agriculture of the section, and in the present paper the term "Great Basin area" is used to include not only the Great Basin proper, but also the region between it and the Rocky Mountains. By far the larger part of the arable land of the Great Basin area lies at an altitude of more than 4,200 feet above sea level. The topography is broken by numerous mountain ranges, so that the arable land is confined to the intervening valleys and wash plains. These wash plains often occur as high mesas, with a gently rolling topography except where they are cut by the courses of streams and recent erosions.

The valleys of water courses are now all more or less developed by irrigation, while the higher mesas which can not be reached by gravity canals remain to be utilized without irrigation, if at all.

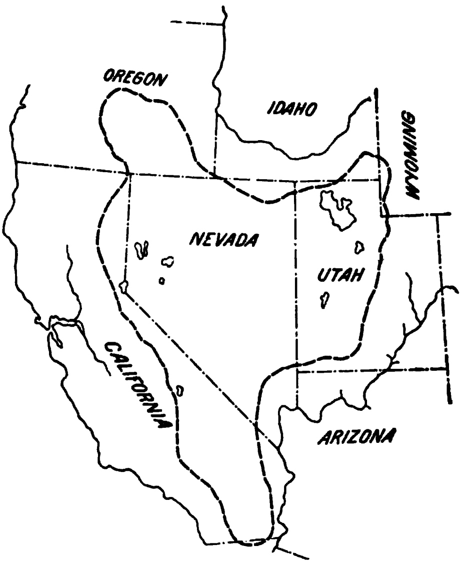

FIG. 1.—Map showing the location of the Great Basin.

In the eastern part of the Great Basin area, where most of the dry farming is now done, the valleys and mesas are relatively small. One or two of them are 15 or 20 miles across, but many are only 1 to 4 miles across and of varying lengths. Often they lie between high timber-covered mountains that furnish perennial streams and a timber supply, as well as valuable range land. In other cases they are surrounded by relatively barren hills, which afford neither water nor timber and yield but little range.

In the northern and central portions of this area the higher and better-watered arable lands are covered with sagebrush (*Artemisia tridentata*) with its gray-green foliage. In the swales on the roll-g mesas the dark green of the rabbit brush (Chrysothamnus) akes a pleasing contrast in the landscape. Among this shrubby rowth various grasses naturally occur, Agropyron, Bouteloua, Stipa, nd Bromus being the genera more commonly represented. In a few calities where conditions are favorable these grasses sometimes form compact sod, but usually they occur in scattered tufts. On exposed ituations and along the foothills, cedars of various species occur in cattering groups, usually marking rock outcrops or stony soil. In the wer valleys, particularly in the heavier and salty lands, the greaseood (*Sarcobatus vermiculatus*) replaces the sagebrush as the charcteristic shrub, with intermingling grasses or sedges where enough oisture is available and with various saltbushes and saltworts, pecies of Atriplex and Dondia, where moisture is scant or alkali bundant.

In the southern part of the Great Basin area the sagebrush is eplaced on the better lands by the creosote bush (*Covillea tridenata*), while the lower and more alkaline lands are occupied almost xclusively by the greasewood and the saltworts mentioned above. long the water courses willows and cottonwoods are common, but side from these the arable lands are treeless and easily brought nder cultivation.

EXPERIMENTS IN DRY FARMING IN THE GREAT BASIN.

The first agricultural settlements in the Great Basin were made long the courses of streams, where water could be diverted for irrigation, and apparently for a long time no one thought farming withut irrigation possible. As a consequence the early agriculture of he region was confined to relatively intensive irrigation farming and o ranging cattle and sheep on the higher lands. Irrigation farming ncluded the production of most of the staple crops common to Amercan agriculture, but with considerably more emphasis on wheat and lfalfa than on any other crops. According to the census of 1900 he State of Utah had somewhat more than 686,000 acres in specified crops. Of these, about 190,000 acres were devoted to wheat, bout 270,000 acres to alfalfa, and nearly 115,000 acres to hay and other forage crops; in other words, nearly 85 per cent of the total creage was devoted to these crops. Unlike the other irrigated sections of the West, the Great Basin area produces a considerable acreage of oats under irrigation. The area devoted to this crop in the Great Basin in 1899 was slightly more than 43,000 acres, while barley, which is the most important cereal besides wheat usually grown under irrigation in the West, was grown on less than 9,000 acres of Utah land. Corn is grown only to a limited extent, there being reported for 1899 only 11,000 acres, while 10,000 acres were devoted to potatoes and 5,000 acres to miscellaneous vegetables. Sugar beets and orchard fruits are important features among the agricultural industries of the area. The latter are both intensive crops, yielding high returns per acre. There were grown 7,500 acres of sugar beets and 16,000 acres of orchard fruits in 1899. These areas seem small for a whole State, but it should be remembered that only a relatively small part of the State has yet been utilized for agriculture. There remains much valuable land to be developed, both with and without irrigation. During the decade from 1889 to 1899 the irrigated acreage in Utah increased 138.8 per cent, or from 263,473 to 629,293 acres, and progress has been fully as rapid since, so that these figures may be increased safely by 50 per cent in estimating the present status of the agriculture of the area, and the indications are that the acreage devoted to dry farming has increased more rapidly even than the irrigated acreage.

In the State of Nevada, which lies almost wholly in the Great Basin, there is at present practically no farming without irrigation. The Twelfth Census reports for the State for 1899 a total in specified crops of 328,458 acres, of which 323,352 acres, or all but 5,000 acres, were irrigated. The difference, or unirrigated land, was nearly all in wild hay and probably irrigated naturally by overflow. There are without doubt numerous valleys in Nevada where dry farming is possible, but there is no evidence that any of these have yet been developed.

The portion of Oregon included in the Great Basin is as yet almost entirely without settlements, so that whatever resources it may have in the way of lands adapted to dry farming are still unknown.

Probably the most striking feature of the agricultural practice of Utah farmers is the lack of an intertilled annual crop to be grown in rotation with the cereals and hay. The discrepancy between the combined acreage of the three important intertilled crops (corn, potatoes, and sugar beets) as compared with the cereal and hay crops is very marked, there being only about 30,000 acres of this class of crops as compared with more than 550,000 acres of cereals, alfalfa, and tame grasses, or 1 acre of intertilled crops to 18 acres of the others. This discrepancy shows the acute need of finding varieties of such crops as corn and sorghum that can be used profitably in rotation with the cereals and forage crops, for it is difficult to secure the best results in general farming without the use, at least occasionally, of an intertilled crop in the rotation. This is particularly true in farming without irrigation, for crops that can not be cultivated during the growing season permit the waste by direct evaporation of a large amount of soil moisture, while with crops that can be intertilled there should be but little more moisture removed from the soil than is required by the crop itself.

PRIVATE EXPERIMENTS IN DRY FARMING.

It is not the present purpose to devote much space to an account of the beginning of dry farming in the Great Basin, but it may be said in passing that it was probably first systematically tried in the Cache Valley, near Logan, Utah, about 1870, or shortly before. The first attempts resulted in failure, but in a few years enough had been learned to justify a continuation and even a considerable extension of the practice. The idea seems to have spread slowly at first, and it has been only since 1885, or later, that it has reached any appreciable proportions, even in the Cache Valley, where water for irrigation was until recently ample for the needs of all the settlers.

Within the past two decades, and particularly during the last one, there has been an enormous increase in the acreage farmed without irrigation, until practically all the arable land in this valley is now utilized either with or without irrigation. The Twelfth Census, which gives the acreage of crops grown in 1899, reports a total of 58,658 acres irrigated in Cache County, which includes the Cache Valley and little else, while the total acreage in specified crops for the same year is nearly twice that area, so that for that year the acreage farmed without irrigation nearly equaled the irrigated acreage. The increase in acreage devoted to both kinds of farming has been rapid since 1899, and it is probable that at present there is more dry-farmed land in this valley than irrigated land. In the Bear River Valley and in the valley of the Malade River there is also a large area of dry-farmed land, which is rapidly extending northward and westward.

Along the eastern shore of Great Salt Lake, on the lower benches of the Wasatch Mountains, there are isolated patches of land farmed without irrigation, but in some of these cases, at least, there is probably subirrigation from seepage water. On the foothills of the west side of the Jordan River Valley, between Utah Lake and Great Salt Lake, and also in Utah County east of Utah Lake, there is now considerable dry farming on the higher lands. Much of this is of very recent development.

Directly south of Great Salt Lake, in Tooele County, Utah, there is a broad valley in which dry farming is now practiced to a considerable extent. In the eastern part of Juab County and south of Utah Lake, between Nephi and Levan, there has been a very rapid development of dry farming within the past six years.

The accompanying sketch map (fig. 2), which shows approximately the location of the irrigated land in the State of Utah, may serve to show also the location of the land farmed without irrigation, since it is only around the edges of the irrigated land that dry farming is at present carried on.

In the southwestern part of Utah, in Iron and Washington counties, dry farming is still in the experimental stage, but there are several valleys in these counties where success seems assured if proper methods are followed. In the southeastern part of the State, in San Juan County, there is a high plateau extending eastward into Colorado which probably contains a million acres of arable land adapted to dry farming. (See Pl. II, fig. 2.) This part of the State is difficult of access and is at present but little known.

In addition to the localities mentioned, there are many others in Utah and western Colorado where dry farming is, or may be, successfully carried on, at least supplementary to irrigation, if not independently.

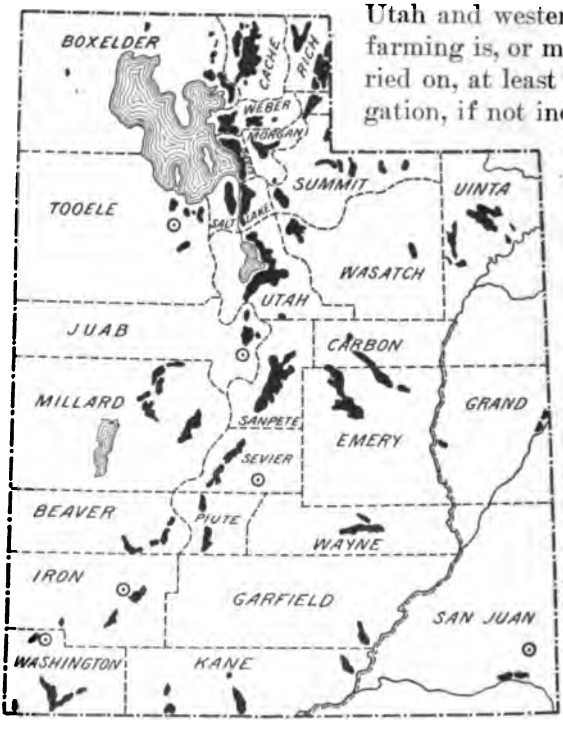

FIG. 2.—Sketch map of Utah, showing the irrigated areas according to the census of 1900 and the location of arid experiment farms.

THE UTAH ARID EXPERIMENT FARMS.

The importance of dry farming as a factor in the development of the State of Utah has been recognized by the people of that State to the extent that the legislature has made direct appropriations to establish and maintain experiment farms for working out scientifically the best methods of tillage and rotation and for testing crops and varieties to find those best suited to local conditions. Six such farms have been established in representative parts of the State; their approximate locations are shown on the sketch map, figure 2. These farms were provided for by an act of the Utah legislature approved March 6, 1903. Each of them contains 40 acres of land, is equipped with the necessary farm machinery, and is well fenced, but has no other improvements. The work is directed by the officers of the State Agricultural Experiment Station at Logan, Utah, while each farm is under the direct charge of a local superintendent. All the labor required, whether of men or teams, is employed by the day or by the hour from near-by farms. No live stock is kept on the farms.

On each of these farms systematic experiments have been planned with a view to working out some of the more important tillage and crop problems, both general and local. The land is laid off in long, narrow strips, which are subdivided crosswise into plats ranging from one-fifth to one-third of an acre in size. Except for a few experiments, these strips or series of plats are alternately put in crop and given a clean summer fallow. Plate I, figure 1, shows one of these experiment farms with the alternate series in crop and in fallow, while Plate II, figure 1, shows a portion of one of the fallow series and the way the surface mulch is maintained. The plans of the experiments and descriptions of the stations have been published by the Utah Agricultural Experiment Station, and the reports of results obtained are to be published from time to time, as required by the law under which they were established.[a]

These experiment stations, representing as they do a variety of conditions within the State, promise to be of great value in solving some of the problems of dry farming, particularly if they can be continued for a considerable length of time. From the fact that the same general plan of experiments is being followed on each of them, opportunity is offered to get a perspective on the results that would be quite impossible with only one or two such stations. In addition to this, these farms serve in a measure as demonstrations of what can be done and how best to do it in each of the sections where they are located. Such demonstrations are of the greatest value to a community, for the lessons of proper tillage methods for moisture conservation are hard to learn except by costly experiment or continued observation.

LOCAL CONDITIONS WHICH AFFECT DRY FARMING.

From the standpoint of dry farming the most important feature of climate is the precipitation; its amount, its distribution through the year, the variation in amount from year to year, and the way it falls—whether chiefly as snow, as frequent light showers, or as occasional torrential rains. These factors are, of course, all closely interrelated with others, such as temperature, atmospheric humidity, wind movement, and the character of the soil.

The success or failure of dry farming in the Great Basin is largely influenced by local conditions of climate and soil, so that a careful investigation of these conditions is well warranted, not only by anyone studying the subject as a whole, but also by anyone proposing to begin such farming in that region. Some of these conditions, such as the character and annual distribution of the rainfall, are much the same for the whole region, but other conditions, such as the actual amount of the rainfall, are largely influenced by the local topography and therefore vary greatly even within a limited area.

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[a] "Arid Farming in Utah," Bul. 91, Expt. Sta., Utah, January, 1905, and "Memorandum of Plans for Arid Farm Investigations," Circulars No. 1 and 3, Expt. Sta., Utah, April, 1904, and April, 1905.

PRECIPITATION MAINLY IN WINTER.

In the Great Basin, as in nearly all of that part of the United States lying west of the Rocky Mountains, the larger part of the precipitation occurs during the winter rather than during the summer months. In this respect the climate differs from that of the great semiarid region east of the Rocky Mountains.

Contrary to the generally accepted opinion, there seems to be good reason for believing that more economical use of a limited rainfall is possible when the larger part of it takes place during the winter than when the rains are mostly confined to the summer months. This is particularly true when the rainfall is too light to produce a crop every year, so that summer fallowing or alternate-year cropping is necessary to conserve the scanty supply.

There are several reasons for this. When the rain comes during the cool weather a much smaller percentage of it is immediately evaporated than in warmer periods, so that more of it soaks into the ground. When rain falls on the hot, dry ground in midsummer it takes at least one-fourth of an inch to wet the surface and establish connection with the moist soil below, while on the heavier soils at least one-half inch is needed to penetrate the dry surface. After the rain has ceased a considerable quantity of water evaporates before the surface is dry enough to cultivate, if cultivation is possible, while with standing grain and similar crops the direct evaporation from the soil continues until all moisture within reach of the surface that has not been taken up by the plants meanwhile is lost into the air.

With a favorable soil—a soil with sufficient fine material to have a high water-holding capacity, yet with enough coarse material to permit easy penetration of rain water—the best use of a limited rainfall is possible when it occurs during the cooler months, either as snow or as slow rains of one-half an inch or more at a time, so as to give a maximum of penetration and a minimum of run-off and evaporation. This is, of course, not true for all climates nor for all soil types. Where the winters are long and severe, so that the ground is deeply frozen, winter precipitation would be largely wasted in surface run-off and by evaporation before the ground thawed out in the spring; while on shallow soils or soils with a relatively small amount of fine material, and consequently a low water-holding capacity, the rain that falls, except during the growing season, is largely lost by percolation to depths beyond the reach of plants.

It is well known that moisture may be lost very rapidly from a soil if the surface is not stirred soon after a rain. It is, therefore, only with intertilled crops that rain can be economically utilized during the hot growing season. For crops that can not be intertilled, such as wheat, oats, and barley, the greatest economy of soil moisture is possible if no rain falls after the crop is sown, or at least after the last surface tillage is given.[a] Where the soil is fairly heavy and deep it can hold available sufficient moisture to mature any ordinary crop, provided losses by direct evaporation are nearly or quite prevented.

The growing season of the ordinary crop plants is set within fairly definite limits. If moisture is not supplied at about the time it is needed, the plants either die outright or are injured beyond recovery. In farming with a limited rainfall there is therefor much less risk involved where it is possible to store in the soil during a whole year enough water to carry a crop to maturity than where it is necessary to depend on the chances of rains at just the proper time during the growing season. There is much less chance of a year-long drought than of a drought of two or three weeks during the summer when rain is badly needed for crops.

In figure 3 is shown the average monthly precipitation at four representative points in the eastern part of the Great Basin, while for purposes of comparison similar diagrams are shown of the precipitation at four representative points in the Great Plains area which lies on the eastern slope of the Rocky Mountains. The diagrams are arranged to show the average amount of precipitation in inches of water for each month in the year, and the months are arranged in the order of the calendar year, with January on the left and December on the right.

It may be seen at a glance that the seasonal distribution of the precipitation is strikingly different in the two regions represented. In the Great Basin the larger part of the rain falls in the autumn, winter, and early spring, while except at Parowan[b] the midsummer rainfall is almost negligible. On the other hand, the characteristic feature of the Great Plains climate is its relatively heavy summer rainfall and its dry winters.

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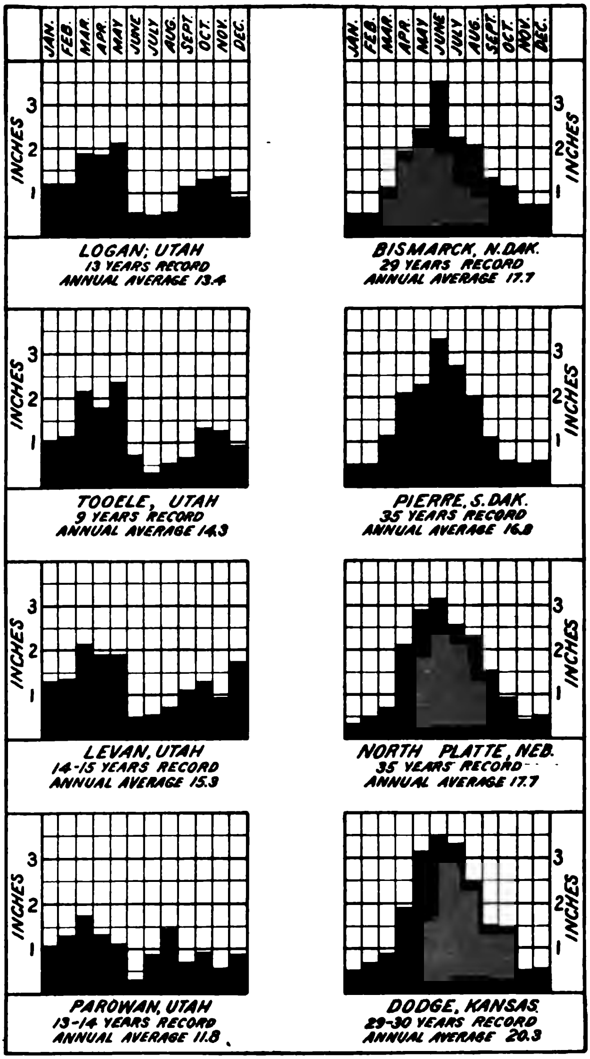
[a] In the case of autumn-sown cereals it is not only practicable but decidedly advantageous to harrow the crop in the spring as late as it can be done without injuring the grain.

[b] Parowan is evidently far enough south to share somewhat in the torrential summer rains that often occur in Arizona and New Mexico.

ANNUAL VARIATION IN RAINFALL.

There are no rainfall records covering long periods of time for the places in the Great Basin where dry farming is now attracting the most attention. The earlier settlers were interested chiefly in irrigation farming and gave but little attention to rainfall. With few exceptions such records as are in existence have been made in cities or towns that were located with reference to irrigation or transportation facilities rather than in representative agricultural regions, and consequently the available records are of limited agricultural applition.



LOGAN; UTAH
13 YEARS RECORD
ANNUAL AVERAGE 13.4

BISMARCK, N.DAK.
29 YEARS RECORD
ANNUAL AVERAGE 17.7

TOOELE, UTAH
9 YEARS RECORD
ANNUAL AVERAGE 14.3

PIERRE, S.DAK.
35 YEARS RECORD
ANNUAL AVERAGE 16.8

LEVAN, UTAH
14-15 YEARS RECORD
ANNUAL AVERAGE 15.3

NORTH PLATTE, NEB.
35 YEARS RECORD
ANNUAL AVERAGE 17.7

PAROWAN, UTAH
13-14 YEARS RECORD
ANNUAL AVERAGE 11.8

DODGE, KANSAS
29-30 YEARS RECORD
ANNUAL AVERAGE 20.3

FIG. 3. –Diagrams showing the average monthly precipitation at some representative points in the semiarid West.

The following charts show the total annual precipitation at four places in Utah where dry farming is now carried on to some extent. In fact, the two towns Logan and Levan probably represent the best and most extensive development of dry farming in that region. Such records as these are valuable in proportion to their length, for when long continued they furnish a basis for interpreting present conditions without which wrong judgment would be almost certain.

Logan, Utah, is situated near the northern boundary of the State, near the eastern side of the Cache valley, in which dry farming has been carried on for nearly a third of a century, and it is now probably the most important dry-farming section in the State. Except on the eastern side the valley is surrounded only by low hills, so that the rainfall is probably very evenly distributed over it. The record shown in the diagram (fig. 4) covers a period of fourteen years, from 1893 to 1906, inclusive, the annual average being 15 inches. It will be noted that for the period of record previous to 1906 the variation from the mean was slight, but in 1906 the amount of rain was nearly double what it was in 1905.

Tooele, Utah, is situated near the eastern edge of a broad valley directly south of Great Salt Lake. This valley, which lies at an altitude of about 4,500 feet, is one of the largest in the State in which dry farming is possible. The region around Tooele has not been used for dry farming until within the last three or four years. Records are available for the last ten years only. The annual average for that time is 15 inches, while the extremes range from about 10 inches to slightly over 20 inches. (See fig. 5.) It will be noted in this case, also, that the rainfall during 1906 was the greatest recorded, although the difference is not so marked as in the record for Logan.

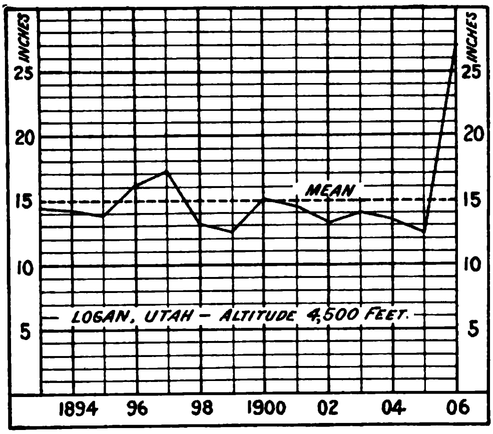


FIG. 4.—Diagram showing the total annual precipitation at Logan, Utah, 1893-1906.

Levan, Utah, is situated in a comparatively narrow valley in the central part of the State, a short distance south of Nephi. This valley is in one of the older settled sections of the State, and since 1900 it has been the scene of very rapid development of dry farming. This record also shows an unusually large rainfall during 1906, which was exceeded only in 1895. (See fig. 6.) It is clear from such a record as this that frequent crop failures can be avoided only by tillage methods by which a reserve of moisture is stored in the soil for the use of crops during the drier years.

Parowan, Utah, is situated near the southern part of the State in one of the smaller valleys east of the Escalante Desert. The annual average for the fourteen years recorded is 12.5 inches, while the extremes range from 21 inches as the highest to 7 inches as the lowest.

In this case, again, the unusual rainfall of 1906 is shown. It becomes apparent from a comparison of this (fig. 7) and the preceding diagrams that the rainfall of 1906 was much above the average in the Great Basin. The relatively large rainfall of 1906 has stimulated local interest in dry farming in a way that nothing else could do.

The wonderfully large crops obtained during the last season without irrigation, together with the recent unusual interest in dry farming, have combined to convince the local public that irrigation is rapidly becoming unnecessary in that region. In fact it is not generally realized how much more rain there was during the last year than usually falls. It is true that the present agitation in favor of dry farming in Utah was actively begun in 1902 and 1903, when the rainfall was rather below the average, so that while the greater rainfall of last year has probably encouraged unwarranted hopes as to what can be done without irrigation, yet the actual extension of farming has doubtless been much greater than it would have been without the increased rainfall. There can be no doubt that there will soon be drier years again, for the records of rainfall show no reason for believing that the climate is changing.

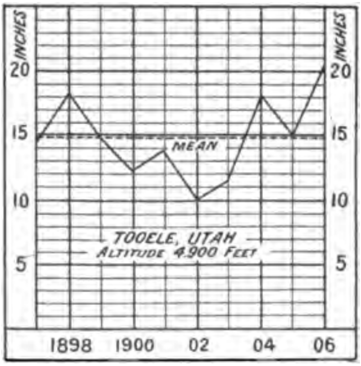


FIG. 5.—Diagram showing the total annual precipitation at Tooele, Utah, 1897-1906.

INFLUENCE OF LOCAL TOPOGRAPHY ON RAINFALL.

The air currents that bring rain into the Great Basin come mainly from the west, saturated with moisture from the Pacific Ocean. A large part of this water in the lower atmosphere is precipitated as this air passes over the high Sierra Nevada range, but enough moisture is soon recovered either from the upper air or from the earth for each of the successive mountain ranges in the Great Basin to receive its share of rain, the amount in each case increasing with the height of the ranges and their distance apart. Thus, just as the western part of the Great Basin is more arid than the eastern part, so the western side of each valley in the Great Basin is drier than the eastern side; or, conversely, the western slope and foothills of a mountain range receive more rainfall than the eastern slope, the difference depending somewhat upon the height of the range. (See fig. 8.)

The following table illustrates this phenomenon. The town of Deseret lies well out in a broad valley which is much too dry for any farming except with irrigation. About 30 miles southeast of Deseret is the town of Fillmore, which lies close to the western slope of a mountain range, the crest of which is 10,000 feet above sea level. In the first part of the table is shown the total annual precipitation at Deseret and Fillmore for all the years for which there are records, and also the difference in favor of Fillmore due to the effect of the mountains.

In the second part of the table Fillmore is compared with Richfield, which is only 16 miles away, but on the opposite side of the mountain range. Here also all the available records for both places are given. In this case the difference is even greater than is shown in the first case. Such facts show plainly that it is useless to estimate the probable rainfall at any place in this region where records have not been kept unless the topography is well known and direct comparison is possible with a similar location where the facts are known.

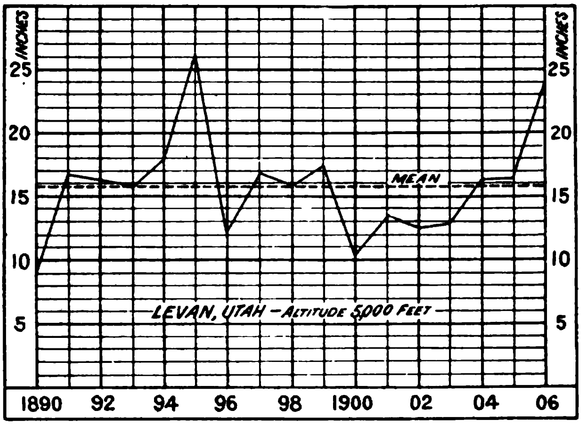


FIG. 6.—Diagram showing the total annual precipitation at Levan, Utah, 1890–1906.

TABLE I.—*Differences in total annual precipitation between points in Utah located near each other, arranged to show the influence of topography.*

Year.	Deseret and Fillmore.			Fillmore and Richfield.		
	Deseret (altitude, 4,600 feet).	Fillmore (altitude, 5,700 feet).	Difference in favor of Fillmore.	Fillmore (altitude, 5,700 feet).	Richfield (altitude, 5,308 feet).	Difference in favor of Fillmore.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
1893	7.6	15.6	8.0			
1894	8.0	13.4	5.4			
1898				14.6	4.5	10.1
1899				14.5	8.3	6.2
1900	5.4	9.3	3.9	9.3	1.8	7.5
1901	9.0	12.9	3.9			
1902	4.8	11.9	7.1	11.9	6.6	5.3
1903	7.0	12.0	5.0			
1904	7.1	12.1	5.0	12.1	5.2	6.9
1905	9.7	16.1	6.4			
1906[a]	10.5	20.0	9.5	20.0	6.6	13.4
Average	7.7	13.8	6.1	13.7	5.5	8.2

[a] July records missing.

METHODS OF INTERSEASON TILLAGE.

The methods of farming now in use on the dry lands of the Great Basin area are largely the results of private experiments, and consequently they possess some local peculiarities. It should be kept in mind that there are some unusual features of climate and soil in this region, such as the relatively light summer rainfall and a deep heavy soil that holds large quantities of water.

Deep plowing, frequent cultivation, and alternate-year cropping have been used in retaining soil moisture. Wheat sown in the autumn has been the chief crop grown on the dry lands, and for this reason the land is plowed in the late summer as soon as possible after the crop has been removed. The land is left in the rough furrow all winter, and as soon as the winter rains have either soaked in or dried off, surface cultivation is begun. This cultivation is done chiefly with a disk harrow, though other implements are also used. Sometimes a shallow summer plowing is given to kill and turn under any weeds that have escaped the lighter cultivation. In the late summer the spike-toothed harrow and other smoothing implements are used to prepare a fine seed bed, and the next crop is sown in September or early in October. Since the winter rains compact the soil and get it into such a condition that the direct loss of water would be easy, it is often found desirable to lightly harrow the wheat crop in the early spring, for after it starts to grow nothing more can be done toward preventing the loss of water until after harvest. Since wheat growing involves only the simpler farm operations, which may be performed on a large scale, there have been special inducements to use large machinery and to economize the use of men.

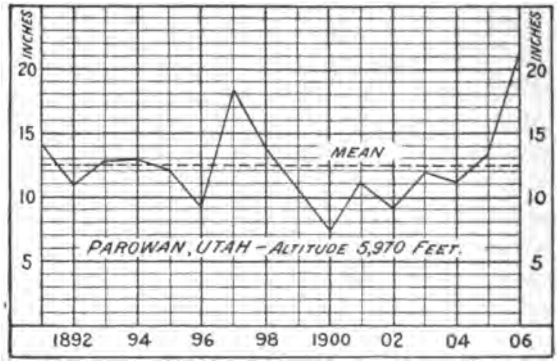


FIG. 7.—Diagram showing the total annual precipitation at Parowan, Utah, 1891-1906.

Large gang plows and large harrows are in common use, and the grain header is used almost exclusively in harvesting the crop. In a few cases steam is used as motive power for plowing, and apparently with success. Where used it is always with a traction engine, which draws the plows behind it instead of working with a cable and operating from both sides of the field.

No reliable data are at hand for estimating the relative cost of using steam and animals for plowing. The steam outfit requires a large initial investment, and can hardly compete with animals except where there is so much land under cultivation that it can be used a large part of the time.

Aside from the ordinary moldboard plow, the disk plow is extensively used in dry farming in Utah. The disk plow can be employed in plowing land when it is dry and hard, which is highly important, and it also pulverizes the furrow slice when the land is dry rather better than the moldboard plow. The disk plow can also be used in large gangs, and thus works very well behind a traction engine. For summer fallow plowing a light disk plow in gangs is very popular. Such a plow is about half way between an ordinary disk plow and a disk harrow. It cuts about 4 or 5 inches deep and turns the furrow sufficiently to cover any weeds or trash.

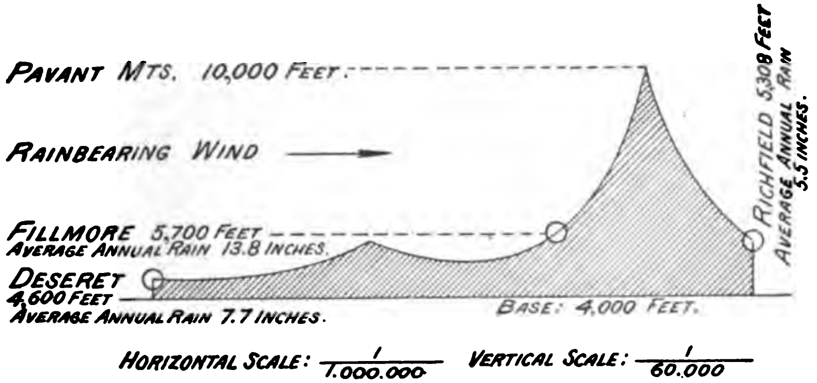


FIG. 8.—Profile sketch showing the relative positions of Deseret, Fillmore, and Richfield, Utah.

Where subsoiling is practiced, the use of a subsoiling attachment in a gang plow is found to be not only practicable but preferable. One very satisfactory disk gang plow that is made for use with five or six horses has two large disks for general use, but when subsoiling is to be done the front disk can be removed and a subsoiler attached in its place. This position of the subsoiler has several advantages. It leaves a smooth-bottomed furrow for the furrow horses to walk in and it also immediately covers the subsoil that is loosened by the subsoil plow, thus preventing a considerable loss of moisture that might result from leaving this loosened subsoil exposed to the air until the next round of the plow. There is some question as to whether subsoil plowing is worth what it costs, and many farmers are of the opinion that deep plowing without subsoiling is the better practice.

The ordinary disk harrow is, of course, in very general use, not only for pulverizing the soil in preparing a seed bed but also to maintain the clean fallow which is so essential to success in this type of farming

The spike-toothed harrow is also used almost universally, not only as a supplement to the disk harrow but also to kill weeds and break the surface crust after rains.

In addition to the smoothing harrow for finely pulverizing the surface soil, some farmers have used with advantage a plank drag, usually of home construction, made of three or four planks fastened together rigidly, one behind another, and with the edges overlapping like the weatherboards of a house. This implement crushes the hard lumps and tends to level the land at the same time. For still further smoothing and pulverizing the seed bed a brush harrow is sometimes used. This, too, is of home construction. It is made of brush rigidly fastened to a plank or log in such a way that the loose ends of the brush bear on the soil, acting much like a coarse broom. This brush harrow, when used after a plank drag, leaves the surface soil in excellent tilth.

For preparing new land for the plow, some sort of implement is often needed to remove the sagebrush. For this purpose a common railroad rail is often used, with a team hitched to each end and the rail dragged sideways across the land, breaking down the brush. This may be followed by a heavy rake, which gathers up the loosened brush into piles or windrows for burning. Several other implements have been devised for removing sagebrush, among them a heavy form of revolving hayrake, which breaks down and partly collects the brush in one operation.

MAINTENANCE OF A CLEAN SUMMER FALLOW.

The term "summer fallow" is used with different meanings in various parts of the country. In the Great Plains area, especially in the northern part, it is applied to the practice of letting the land lie idle and permitting the growth of weeds during the spring months, so that a plowing in June will not only kill these weeds but by turning them under add some much-needed humus to the soil. This June plowing also brings to the surface more weed seeds, which soon germinate and may be destroyed subsequently either by surface tillage or by fall plowing. The chief object of the summer fallow as used in the Great Plains area is rather to free the land from weeds than to conserve the moisture. In other sections of the country the term "fallow" is applied to the practice of leaving the land entirely undisturbed either for the whole or a part of the year. In the Great Basin, however, the summer fallow is used chiefly for moisture conservation.

As has been pointed out, the bulk of the precipitation of this region comes in the autumn, winter, and spring months, the summer months being almost free from rain. It is therefore possible to establish early in the season a very effective dust mulch on the surface of the soil, which is not likely to be disturbed by summer rains and which requires only enough cultivation to keep weeds from growing. (See Pl. II, fig. 1.) The maintenance of this surface mulch is an expensive operation even under these conditions, for weed seeds germinate readily in the moist soil below the surface, push up through the dry mulch, and unless quickly killed dissipate large quantities of valuable soil moisture. It is quite as important to keep weeds from developing to any considerable size as it is to maintain a surface mulch that will check direct evaporation. If these weeds are killed at short intervals by light surface cultivation they use but little water, and it is also much cheaper to destroy them when small than after they have grown to considerable size.

It must always be taken into account that the surface soil mulch, which is so necessary to moisture conservation, is possible only where the soil is sufficiently heavy not to be blown away by summer winds. These summer winds, which in some regions are almost continuous and sometimes of high velocity, often make a clean summer fallow altogether impracticable. It is also extremely doubtful if the requisite summer fallowing is practicable on very light soils, for even the milder summer winds would do serious damage where such a soil in a fine state of tilth is exposed.

THE IMPORTANCE OF SOIL TEXTURE.

The water-holding capacity of a soil depends largely upon its physical texture and is also influenced to some extent by the amount of organic matter present. For instance, a heavy clay soil containing a large amount of humus might hold 30 per cent of water and still be in workable condition, while sandy soil having 10 per cent of water might seem very wet. It is therefore obvious that where success in dry farming depends upon the storage in the soil within the reach of plants of enough water to carry a crop to maturity, the water-holding capacity of the soil becomes a matter of the first importance.

TABLE II.—*Increased moisture occasioned by 1 inch of rain distributed through various depths of soil, weighing 85 pounds per cubic foot.*

Depth of distribution.	Proportion of moisture.	Depth of distribution.	Proportion of moisture.
Inches.	*Per cent.*	*Inches.*	*Per cent.*
1	75	24	3.1
3	25	36	2
6	12.5	48	1.5
12	6.2	60	1.2

A cubic foot of heavy loam soil perfectly dry is estimated to weigh 85 pounds. A cubic foot of water weighs about 62½ pounds.

The water required to cover 1 square foot to the depth of 1 inch weighs about 5¼ pounds, while an acre-inch of water weighs about 113 tons. One per cent of moisture per cubic foot of soil is equivalent to 0.84 pound of water, while 1 per cent per acre-foot of soil equals about 18 tons of water.

The preceding table shows the relation between rainfall and soil moisture as stated in percentages. These figures are useful in computing the potential effect of rains of various amounts, assuming that all of the rain enters the soil.

Estimating that a wheat crop, for instance, can use moisture 5 feet deep in the soil, it will be seen that a sandy soil would be able to hold available only about 540 tons of water per acre, while a heavy loam would hold available about 1,350 tons per acre, or a difference of more than 800 tons of water per acre in favor of the heavy soil. These figures show the importance of selecting only the heavier soils for dry farming where the storage of water from one season to another is necessary.

Under their virgin conditions the heavier and better soils of a semiarid region are rarely wet to a depth of more than 3 or 4 feet—often 2 feet or less. With the surface soil undisturbed so that this moisture can move upward and dissipate by direct evaporation, and with the natural vegetation using large quantities, it is only a short time after the rains cease before all the available water is lost from the soil. If this same land is broken by the plow to a depth of 5 or 6 inches, more of the rain water or melting snow soaks into it and penetrates far below the limit of virgin conditions. If, in addition to the first plowing, the surface soil is stirred frequently, a surface mulch is formed which is nearly as effectual in checking direct evaporation as a coat of oil on the surface of water. The moisture thus held in the soil continues downward, wetting soil that in some cases has not been wet for centuries. Since the total annual rainfall in many dry-farming regions is less than 15 inches, of which but little more than half can be secured and held even under favorable conditions, there is ample storage capacity in deep and heavy soils for all the normal rainfall of two years.

In short, the soil of a semiarid region may be regarded as a reservoir which under natural conditions is shallow, with a surface difficult to penetrate and favoring the quick loss of water by evaporation. Under proper methods of tillage the reservoir may be greatly deepened and provided with a cover that will effectually prevent evaporation, so that its supply may be held for the use of crop plants. It is the aim of interseason tillage to accomplish this result. With crops that do not permit intertillage during the growing season the importance of interseason tillage becomes very great, while the extensive use of intertilled crops lessens the need of it materially.

CROPS AND CROP TILLAGE.

Wheat and alfalfa are practically the only crops grown without irrigation in the Great Basin and, of the two, wheat is by far the more extensively grown. Other cereals, such as oats, barley, and rye, are grown in an experimental way, while such intertilled crops as corn, sorghum, potatoes, and field peas are also being tested to a limited extent.

There are several varieties of wheat in common use both on the dry lands and under irrigation. In fact, there has been but little attempt to develop strains or varieties especially for the dry lands. With a few exceptions, the wheats grown are fall-sown varieties of bread wheat (*Triticum aestivum*). They are nearly all light colored and belong to the class known commercially as " soft wheats." The more popular varieties are known locally under the names of Lofthouse, Kofoid, and Gold Coin.

On the State experiment farms a number of varieties of durum wheat (*Triticum durum*) have been under experiment, together with some of the spring wheats of the type grown in the upper Mississippi valley, such as Fife and Bluestem, and also some varieties of the hard, red winter wheats, such as are commonly grown in Kansas and Nebraska. These varieties are all regarded as still in the experimental stage, and they have not yet found their way into general use among farmers.

Alfalfa is the standard forage crop of the Great Basin area, as it is of the entire western United States. Among the people of Utah it is known universally as " lucern," the name under which it was first brought into the Eastern States, and which is derived from the common European name for the plant. This name was probably carried westward to Utah by the early pioneers, who never accepted the Californian name " alfalfa," which has been derived through the Spanish from an Arabic word signifying " the best fodder."

Alfalfa was first grown in the Great Basin only under irrigation, but recently it has been tested rather extensively on the dry lands. Apparently there has been no very serious effort made to secure varieties especially adapted to these dry lands, but instead seed from the irrigated land is harvested and put on the market, together with any seed that may be grown on land without irrigation.

The indications are that valuable drought-resistant varieties of alfalfa could be developed in a very short time if proper attention were given to selecting seed from individual plants or even from some whole fields that appeared to thrive well on a limited supply of moisture. It is true that a large proportion of the alfalfa seed now produced in this region receives very little, if any, irrigation, since a larger seed crop results when the plants are kept rather drier than is required for the best growth of forage. There needs to be a way devised by which it will be practicable to find recognition in the market for seed of alfalfa that is particularly drought resistant, as distinguished from seed of alfalfa that yields well only under liberal irrigation. If such recognition could be had, there would be an incentive for saving seed from the more drought-resistant plants or fields.

There are practically no grass crops grown on the cultivated dry lands of the Great Basin except in an experimental way. The experiment farms referred to are carrying on extensive trials with a number of promising grasses, including species of Bromus, Agropyron, Lolium, and Elymus. There are some indigenous species, particularly of Agropyron and Elymus, that are giving some promise under cultivation.

There is some doubt as to whether any of these grass crops will ever occupy an important position in dry farming, since they are nearly all shallow rooted and can therefore reach but a small part of the available soil moisture when it is really needed; and, furthermore, they are not well adapted to growing with intertillage or surface cultivation of any kind, whereas such cultivation is decidedly essential for crop production on these western dry lands.

TILLAGE FOR WHEAT.

On the dry lands of the Great Basin it is a common practice to grow wheat after wheat on the same land, sometimes continuously year after year and sometimes with alternate fallow years or with only an occasional fallow year, depending somewhat upon the mois-true condition of the soil. The ideal method of wheat farming and the one that appears to be the most profitable, all things considered, is the method of growing a crop every alternate year, with a year of clean summer fallow intervening. In this case the land is plowed deep, about 7 or 8 inches, very soon after harvest, or, if owing to a press of other work it is not possible to plow at once, the stubble is disked as soon as the grain is cut. The grain is usually harvested with a header, so that there is always a large amount of straw to plow under. During the following summer clean cultivation is given the land and wheat is sown again the following autumn.

If, as is often the case, the wheat is overripe when harvested, a considerable quantity shells out of the heads and falls to the ground, so that if the autumn rains come early and this wheat starts to grow there is always a strong temptation to leave the land unplowed. Not infrequently this volunteer wheat does very well and yields a good crop. (See Pl. III, fig. 1.) There are also cases where this first volunteer crop is allowed to reseed itself, but the resulting crop rarely amounts to much, owing to the irregularities of the stand and to the growth of weeds that quickly establish themselves under such conditions. In the long run, it is doubtful whether it ever pays to grow three or even two crops of wheat in succession without plowing the land between crops, for such practice not only wastes valuable soil moisture, but allows the land to become very weedy. (See Pl. III, fig. 1.)

TILLAGE FOR ALFALFA.

The young alfalfa plant is as tender and delicate as the well-established plant is strong and hardy, so that while it is necessary to have the land in excellent tilth and all other conditions favorable for starting this crop, a well-established field may be harrowed and disked, and sometimes even plowed, without destroying or even injuring the plants. In fact, surface cultivation when the plants are nearly or quite dormant, as in the early spring, seems to actually improve the stand and invigorate the growth.

The best results with alfalfa on the dry lands of the Great Basin are secured by early spring sowing with a drill on land that has been previously put in excellent condition of tilth. The seed is usually sown without a nurse crop, and the land should be as free from weeds as possible, for when the alfalfa plants are young they may be easily injured by weeds. During the first summer the new alfalfa field gets no attention except possibly a clipping with a mower set high to cut any rank weeds that may have started and to cut back the taller alfalfa plants. The plants cut down are usually left on the ground to form a mulch. The second summer the alfalfa field is in full bearing and may be cut once for a hay crop, and, if conditions are favorable, enough second growth will be made to give a light second crop.

When seed production is the aim of alfalfa growing, a light hay crop is usually cut very early, before the plants are in bloom, and the second crop is then the larger and sets seed freely. With alfalfa seed at its present price, seed production on the dry lands is much more profitable than the hay crop unless hay is very scarce and high priced.

After the second year a field may be disked and harrowed with impunity without injuring the plants, so that it is quite possible to materially aid in the conservation of soil moisture in alfalfa fields even if the ground is thickly covered with plants. On the dry lands of North Africa it has been found profitable to sow alfalfa in rows and cultivate it from time to time, and even to grow a wheat crop in alternate years without injuring the alfalfa, which would yield fair crops of hay during the fallow years.[a] It is reasonable to believe that similar results might follow attempts to grow alfalfa as an intertilled crop, either with or without wheat in alternate years, in the Great Basin, where conditions are in many respects similar to those in the higher lands of North Africa in the vicinity of Setif, where this method of growing alfalfa is in common practice. The quick response of alfalfa to cultivation is shown in Plate II, figure 2, which is reproduced from a photograph taken in the interior of a dry-land alfalfa field some weeks after the first crop of the season had been cut. The plants along the edge of the field next to the surface-tilled land had made a good second growth, while the plants in the interior of the field, where the available moisture had been exhausted by the first crop, had made practically no second growth.

There seems good reason for believing that sowing alfalfa in rows far enough apart to permit intertillage would be a profitable method on the dry lands, even for forage production, while for seed production it would almost certainly be more profitable. It is well known that isolated alfalfa when allowed to mature on these dry lands produces relatively large quantities of seed. This is probably due, in part, to a better illumination on all sides of the plant, resulting in a larger number of flowers; in part to the drier air surrounding these flowers during the pollinating period, which appears to have some bearing in seed production, and in part to the greater ease of access for insects of various kinds that promote pollination. It is certainly true that the partial isolation of the plants secured by row planting results in greatly increased yields of seed per plant, and there is strong probability that the yields per acre would be larger, so that experiments to determine this point would be well justified.

There is a strong tendency in the Great Basin, as elsewhere in the western United States, to let alfalfa grow in a field as long as it will, which is usually much longer than it is yielding its best returns. In other words, it is not used as a rotation crop, in the ordinary sense of the word. The beneficial effect of alfalfa upon the crop that follows it is generally recognized, but a well-established alfalfa sod is hard to subdue for the following crop, while alfalfa seed is expensive, and it is not easy to get a good, even start on a new field. The temptation is very strong, therefore, to leave alfalfa fields undisturbed, even though the increased yields of succeeding crops are much desired.

THIN SEEDING ESSENTIAL TO BEST RESULTS.

Under ordinary conditions in a humid region or with irrigation, farmers sow about 5 pecks of wheat or 75 pounds per acre, and from 15 to 20 pounds of alfalfa seed per acre. On the dry lands of the

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[a] Bul. 72, Part I, Bureau of Plant Industry, U. S. Dept. of Agriculture.

Great Basin, however, experience has shown that much better crops of wheat result when only 3 pecks of wheat or 45 pounds per acre are sown, while with alfalfa about 8 pounds of seed per acre gives the best results. Some farmers even sow 35 pounds of wheat per acre without apparently decreasing the yield, and careful experiments have shown that even less than 8 pounds of alfalfa seed per acre will give a good crop if evenly distributed, but uniform distribution is difficult with much less than 8 pounds of seed per acre. The beneficial effects of thin seeding are very striking, particularly in the drier years, when a seeding of 75 pounds of wheat results in crop failure, while a seeding of 35 pounds gives a good crop. This apparent anomaly is due to the fact that the heavier seeding results in so large and sudden a demand for soil moisture that the supply within reach is exhausted while the plants are still in the active growing condition and before the seed is formed, while with thin seeding the same amount of soil moisture is sufficient for the plants produced. Both wheat and alfalfa are able to throw out numerous branches from the central stem, so that when moisture conditions are favorable the number of stems actually produced may be nearly as great from thin seeding as from thick seeding.

THE SUSTAINED PRODUCTIVENESS OF DRY-FARMED SOILS.

In a system of farming where wheat is grown continuously, that is, not in rotation with other crops, such as is the case on the dry lands of the Great Basin, the question of maintaining the soil fertility is a natural and important one. It is ordinarily assumed that the continuous production of any one crop, and particularly such a crop as wheat, must rapidly reduce the fertility of the soil. It would seem, however, that with the tillage system for wheat, previously described, by which a clean summer fallow is given every second or third year and a large amount of straw is plowed under after each crop, the reduction of fertility is by no means so rapid as it is in some other regions and under some other conditions.

As a matter of fact, there are fields in some of the older settled valleys in the Great Basin that have been producing wheat every other year for a third of a century without showing any signs of depleted fertility. (See Pl. III, fig. 2.) While actual comparison is of course impossible, there are reasons for believing that some of these fields are capable of producing better crops now than when first plowed. If this be true, it is important to discover the causes involved and to determine whether this tillage method, if it be found a contributing cause, is capable of wider application with a hope of similar results. It must be kept in mind that in the practice followed on these dry lands, where the grain is headed rather than cut with the binder and where a large amount of straw is plowed under and incorporated with the soil, there is probably no reduction of the humus content; in fact, there might even be an increase of the humus under this practice, for the soils in their native condition bear but scanty vegetation, which probably adds organic matter to the soil very slowly.

With this large amount of wheat straw plowed under in the autumn and allowed to lie over the next winter, followed by continued surface tillage, conditions appear to be very favorable to the growth of any bacteria that might aid the conversion of this straw into available plant food. In fact, the conditions under which this surface mulch is maintained seem to be particularly favorable for the activities of nitrifying and other soil-enriching bacteria. It is well known that there are bacteria that under favorable conditions work on the complex proteids in the organic matter of the soil and change them into available plant food in the form of nitrates. In addition to these so-called nitrifying organisms, there are known to be other forms of bacteria that while living chiefly on the decaying nonnitrogenous organic matter of the soil are able to utilize and fix atmospheric nitrogen in much the same way as do those bacteria that live and develop nodules on the roots of some leguminous plants.

THE HEAVY SOILS NOT LEACHED.

The heavier soils such as have been found best suited to dry farming in the Great Basin have such a high water-holding capacity that with the ordinary light rainfall of the region there is no cumulative downward movement of water through them. In other words, the rain water that enters these soils is held by capillary force against the force of gravity, and instead of moving downward to join an underground water table, it is returned to the air either by direct evaporation from the soil surface or by transpiration processes through plants. This is, of course, not true for any but the deeper and heavier soils. Soils that occur as thin layers over impervious material, or those with so coarse a texture as to have a very low water-holding capacity, can not act as effective storage reservoirs. This fact again indicates the desirability of heavy soils for dry farming.

The importance of the fact that some of these dry-farmed soils are not leached by the rain water becomes apparent when it is realized that the soluble salts that result from the ordinary processes of soil weathering and from the activity of various organisms are not washed out of the soil, but remain to be used by plants. The proverbial richness of so-called arid soils, as well as the occurrence of alkali in soils of dry regions, is due to the fact that such soils are not leached by the rain.

THE IMPORTANCE OF ORGANIC MATTER IN THE SOIL.

A continued supply of organic matter in the soil appears to be absolutely essential to successful crop production. It is one of the most important sources of the various forms of nitrogen available to crop plants, and nitrogen in some combined and available form is of course absolutely necessary to plant growth.

Undecayed organic matter is not only useless to plants, but it is also likely to have an injurious mechanical effect upon the soil, at least in a dry region, by keeping it loose and open, thus making moisture conservation difficult. The processes of decay that take place in the organic matter in the soil are varied and complicated. Some of them result in additions to the supply of soluble salts used by plants, while others lead to the complete loss of the constituent substances through their reduction to gaseous forms and diffusion into the air, as in oxidation and denitrification. It therefore becomes important to consider something more in a tillage method than merely adding raw organic matter to the soil. This must be followed by providing conditions in the soil favorable to the activities of those organisms that reduce the organic matter to forms available for plant nutrition with as little waste or loss as possible.

CONDITIONS FAVORING NITRIFICATION.

The processes that result in the decomposition of organic matter in the soil and in the formation of nitrates are favored by a moderate supply of oxygen, the presence of capillary moisture, fairly high soil temperatures, and the presence of free bases to combine with the nitric acid formed. Such conditions are very well provided by the method of tillage used in growing wheat in the Great Basin, as previously described. With that tillage system a large amount of wheat straw with its partially decayed leaves is turned into the soil in the early autumn. The winter rains penetrate the loosened soil, and the continued surface cultivation during the following summer largely prevents the loss of this moisture by evaporation. This surface cultivation also promotes the aeration of the soil, which is essential to the most rapid nitrification, while the absence of plant growth to shade the soil gives the high temperature needed.

The beneficial effects on nitrification processes of the conditions produced by summer fallowing are discussed at some length by Hall[a] in describing the work at Rothamsted, England, where the rainfall is sufficient to leach the soil of the field under experiment:

> It will be seen that the produce of wheat after fallow is considerably higher than when it is grown continuously—17.1 against 12.7 bushels per acre; but if

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[a] Hall, A. D. The Book of Rothamsted Experiments, pp. 62–66; also pp. 221–223, 1905.

THE PHILADELPHIA
JUN 12 1907

reckoned as produce over the whole area, half in crop and half fallow, the whole acre grows much less both of grain and straw than where the crop is grown year after year on the same land.

An analysis of the results from alternately fallowed plats, however, shows the real benefits of fallowing. Both the seasonal rainfall and the amount of leaching from the land were measured for a series of years, and when the years of light rainfall and consequently diminished leaching are grouped together and contrasted with the years of heavy rainfall and increased leaching, it is seen that the yields following the drier season were high as compared with the others. Thus, for the years when the rainfall for the four months, September to December, inclusive, averaged 8.88 inches and the percolation was only 4 inches, the yield after the fallow was 2,743 pounds, as against 1,810 pounds on the continuous wheat plat, a gain of 933 pounds, or 52 per cent. For the group of years when the rainfall averaged 13.66 inches during the same four months and the percolation was 8.92 inches, the wheat after fallow yielded 1,757 pounds, against 1,627 on the continuous wheat plat, a gain of 130 pounds, or only 8 per cent. In other words, as a result of the decreased percolation more of the nitrates were left in the soil.

It seems probable from these results that with conditions such as exist on the dry lands of the Great Basin, where there is practically no loss by percolation, the products of nitrification during a fallow year would be quite sufficient to overcome any tendency toward the exhaustion of these soils.

THE FIXATION OF NITROGEN.

The bacterial action by which the complex proteids of the organic matter in the soil are converted into nitrates or other forms of nitrogen is but one of the several sources of the nitrate supply of soils. It is well known that bacteria living in the roots of some leguminous plants are able to combine atmospheric nitrogen into available forms, and it has been discovered more recently that practically all cultivated soils contain bacteria which are able to combine atmospheric nitrogen and make it available to plants, drawing their energy meanwhile from the carbohydrate material of the soil humus.[a]

There are many indications that the sustained productiveness of the dry-farmed soils of the Great Basin is due, in part at least, to the activities of this latter group of nitrogen-fixing bacteria. The same conditions that favor the action of the nitrifying or humus-reducing organisms also favor the action of the nitrogen-fixing bacteria, viz, a supply of carbohydrate material as furnished by disintegrating wheat straw, a good supply of soil moisture, high soil temperatures, and the presence of alkaline bases to combine with the nitric acid produced.

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[a] Hall, A. D. Science, N. S., 22: 453, 1905.

ORGANIC MATTER LOST BY OXIDATION.

In view of the importance of organic matter in maintaining the fertility of these dry-farmed soils there is a strong incentive to avoid excessive losses by direct oxidation.

In maintaining the clean summer fallow previously described, it is necessary to keep the upper 3 inches of the soil thoroughly stirred to form the surface mulch. This portion of the soil, being very dry and well aerated, is kept in a condition which is most favorable to "burning out" the organic matter which it contains.[a] The loss of organic matter in this way can not very well be avoided, for an effective surface mulch is necessary to prevent the loss of moisture from the lower soil. It is possible, however, to very greatly reduce the loss due to oxidation by deep plowing, which increases the depth of the surface soil in which the nitrification and nitrogen fixing can take place. These processes go on very slowly, if at all, in the soil below the furrow slice, so that deep plowing is very necessary to the best results in dry farming, not only as a factor in securing and conserving soil moisture but also in promoting the activities of the various organisms that work in the loosened soil and help to make it productive.

DRY FARMING SUPPLEMENTARY TO IRRIGATION.

With a few exceptions, the irrigated sections of the Great Basin are surrounded by arable lands which are either too high to be economically irrigated or too extensive to be irrigated with the available water supply. In the great majority of cases these lands receive rainfall enough for the production of some special crops even when it is insufficient to support farm homes or even for the growth of wheat and alfalfa with the best of tillage.

It is very doubtful whether a settler would be safe in attempting to make a home and start a farm on even the more promising of these dry lands. At the present time almost all the farming on the dry lands is done in connection with some irrigation farming. In many cases the farmer has little more than his garden and orchard under ditch, but it is at least enough to insure him fruits and vegetables for his table, and, if need be, a little forage for his stock in the event of a severe and protracted drought.

This plan of utilizing the unirrigable dry lands is much safer for the individual and is also much better for the community. Farming with irrigation usually costs more per acre than dry farming, so that wherever it is possible to grow the cheaper staple crops without irrigation it pays to make the attempt. The products of the irrigated land, such as vegetables, fruits, and the succulent forage crops, then find a larger local market, because they can not be produced without irrigation, while live stock and some grain crops can often be produced much more cheaply on the dry lands. Thus the two portions of a community can supplement each other to the profit of both.

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[a] Storer, F. H. Agriculture, 2: 28-29, 1902.

One of the most important effects of the development of dry farming adjacent to an irrigation settlement is the much-needed lesson it teaches of the value of tillage. Overirrigation with little or no tillage is the most common and serious failing of the western farmer. It is only where irrigation water is costly or can not be had at any price and when crops actually begin to fail that cultivation is seriously resorted to. As a result, it is only in those sections where irrigation is very new or where water is very scarce that the serious effects of overirrigation are not felt. Once the habit is formed, it is much easier to irrigate than to cultivate when a crop shows signs of distress. The ground is therefore filled with water, low places are swamped or made too alkaline for crops, and the fertility of the land is seriously impaired.

With the development of dry farming, however, the beneficial effects of tillage in conserving moisture and in increasing soil fertility give a constant and striking object lesson. When it becomes apparent that many of the same crops can be grown with adequate cultivation and without irrigation as successfully as they can be grown with irrigation alone, a farmer hesitates before undertaking to share the burden of expensive extensions to existing irrigation works. When the extension of a cultivated area is demanded, it becomes at once a practical question whether increased cultivation or increased construction shall be the basis of such extension. Wherever cultivation is resorted to in connection with irrigation the benefits are at once apparent, but without some continued object lesson or some real need, such as scarcity of irrigation water, it is seldom seriously undertaken.

MAKING A HOME ON THE DRY LANDS.

In any situation where dry farming is possible in connection with even a small amount of irrigation, there is much less risk involved than where there are no such opportunities. In fact, in any place where the rainfall is so light as to require extraordinary tillage methods in the production of ordinary crops there is considerable risk in establishing a home without the possibility of using irrigation for at least the farm garden. In nearly every semiarid region the variation in rainfall from year to year is very great, so that one must expect to experience occasional or even frequent dry years, when even with the best of care the ordinary garden crops would fail, and there might even be a shortage of forage for the stock.

It is therefore highly important in selecting a farm on the dry lands to secure provision for some irrigation, at least for the garden. The larger part of the dry lands of the western United States have underground water within reach. Some of them, indeed, overlie artesian basins, so that deep wells supply an abundance of water. In other cases water can be had by lifting, and with windmills or small engines it is considered quite feasible to lift water 200 feet or more for domestic uses and for garden irrigation.

A garden of some kind is almost a necessity for a farm home on the dry lands, as elsewhere, and the means and methods of providing it should be among the first considerations of a new settler.

It is sometimes possible to maintain a garden by taking advantage of the surface run-off after torrential rains, which may be collected by intercepting ditches and run into broad, shallow trenches in the garden until it settles into the ground. A view of a garden in which this method is used is shown in Plate IV, figure 2.

Where ground water lies very deep the expense of reaching it is often too great to be borne by a farmer individually, especially by a new settler, and it is then necessary to attempt a solution of the problem on a community basis. There are vast areas of land in the western United States with enough rainfall for dry farming, yet without any easily available supply of ground water even for domestic use. In some such regions it is often possible to collect rain water from buildings and store enough in cisterns for culinary purposes, but this is sometimes out of the question for a new settler in a treeless country, where building material is scarce and high priced and where he must be content to live for the first few years in a tent house or a small shack. In such situations the water problem must be solved by a community action.

In some instances the extension of dry farming around irrigated centers is limited only by the distance which farmers can afford to haul water to supply the horses or engines required for the farm work. In other cases large tracts of land that are well suited to dry farming are remaining undeveloped because of the absence of springs and the uncertainty as to the presence of an underground supply of water within reach and, if found, as to the proper location of wells.

One of the most urgent needs for the further development of dry farming in the Great Basin is a hydrographic survey for the purpose of determining the location and extent of the underground water resources. Without the information that such a survey might furnish, settlers must either remain in immediate contact with an existing water supply or waste much money that they can ill afford to lose in blind attempts to locate water for themselves.

SUMMARY.

Dry farming in the Great Basin is limited at present almost entirely to the State of Utah, where it has been carried on to some extent since 1875 and its practice has been increasing rapidly since 1900. The work was initiated by private experiments, but the State of Utah is now supporting six experiment farms for testing varieties and working out scientifically the best rotation and tillage methods.

The precipitation comes during the autumn, winter, and spring months, differing in this respect from the precipitation on the dry lands east of the Rocky Mountains, where it comes during the summer months. Farming is successfully carried on with an annual average rainfall of 15 inches or slightly less. The annual variation in rainfall is considerable and the year 1906 was unusually wet. Local topography has a marked effect on the amount of rainfall.

Clean summer fallowing and alternate-year cropping, together with thorough tillage, are the basis of successful dry farming in the Great Basin.

Wheat and alfalfa are the most important crops now grown on the dry lands of the Great Basin. Thin seeding is found essential to the best results with these crops.

Under the best methods of tillage the land appears to remain highly productive even where no other crop than wheat is grown.

Dry farming is now used only as a supplement to irrigation farming. There have been few attempts to make homes on the dry lands.

The independent extension of farming on the dry lands depends upon the development of underground water for domestic use.

PLATES.

103

39

DESCRIPTION OF PLATES.

PLATE I. Fig. 1.—A general view of the San Juan County Arid Farm, a 40-acre farm maintained by the State of Utah for experimental purposes, located at Verdure, near the town of Monticello. This is one of six farms maintained by the State for similar purposes. The vegetation in the foreground is chiefly black sage, while the trees are juniper. Fig. 2.—A field of wheat in shock on land adjacent to the San Juan County Arid Farm. This field was covered with black sage two years ago.

PLATE II. Fig. 1.—Field showing the type of summer fallow maintained in every other series on the San Juan County Arid Farm. This serves at once to kill out weeds, conserve moisture, and promote humification in the soil. Fig. 2.—The interior of an alfalfa plat on the San Juan County Arid Farm. This alfalfa had been cut once and the plants in the interior of the plat made no second growth, while those along the margin next to the well-cultivated roadway were ready for a second cutting at the time shown in this illustration.

PLATE III. Fig. 1.—A poor crop of wheat on the Sevier County Arid Farm, Utah. The failure of this crop was apparently due chiefly to a lack of proper tillage during the previous season. Fig. 2.—A crop of wheat grown without irrigation in the Cache Valley, Utah. This land has been producing a crop of wheat every other year for thirty-five years. (Photographed by Mr. Charles J. Brand, 1906.)

PLATE IV. Fig. 1.—Harvesting wheat grown without irrigation near Nephi, Utah. A header like that shown will harvest about 25 acres a day. (Photographed by Mr. Charles J. Brand, 1906.) Fig. 2.—A hillside garden in a semiarid region, showing one of the settling ditches used to catch and hold the water which runs off the hill above.

THE PHILADELPHIA
JUL 12 1907
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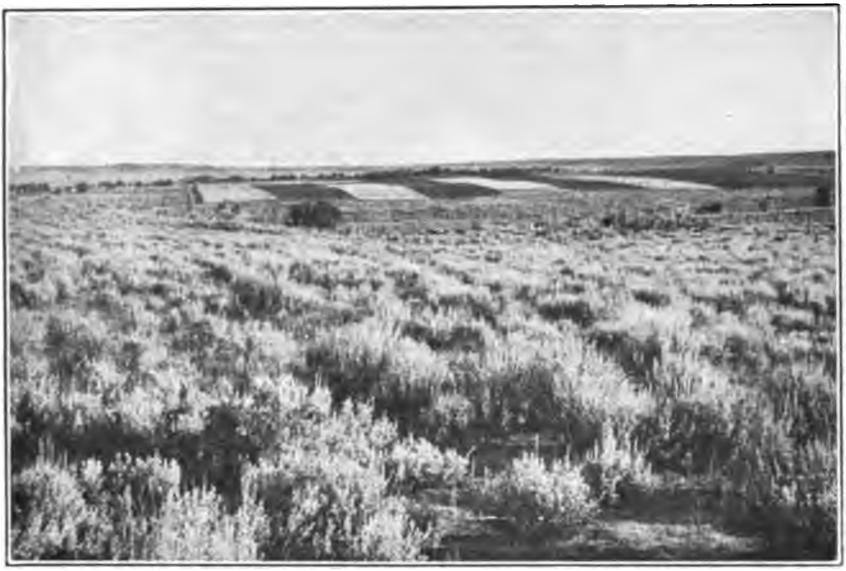

FIG. 1.—GENERAL VIEW OF THE SAN JUAN COUNTY ARID FARM, UTAH.

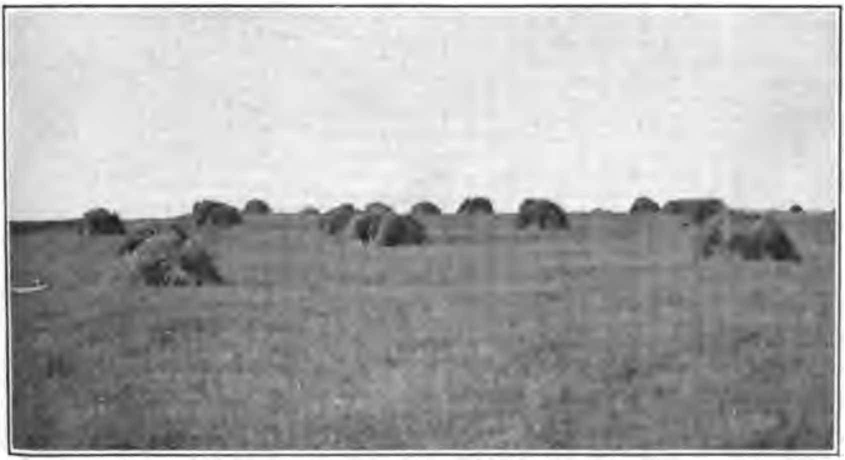

FIG. 2.—FIELD OF WHEAT IN SHOOK ON LAND ADJACENT TO THE SAN JUAN COUNTY ARID FARM.

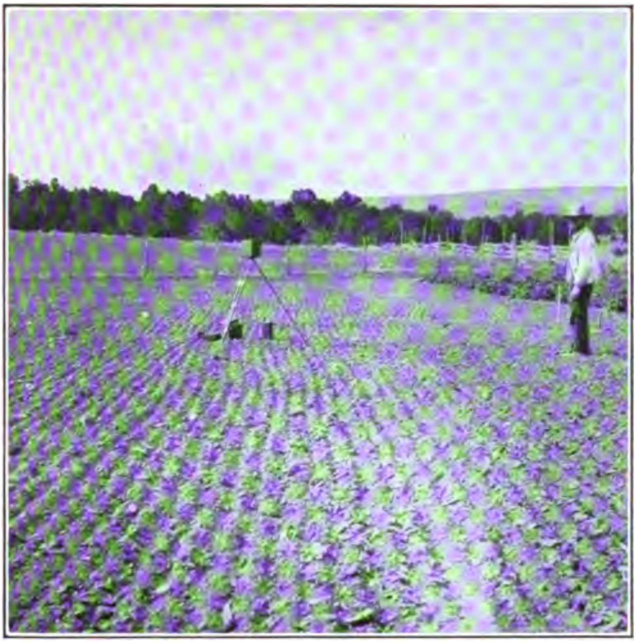

FIG. 1.—FIELD SHOWING THE TYPE OF SUMMER FALLOW MAINTAINED IN EVERY OTHER SERIES ON THE SAN JUAN COUNTY ARID FARM.

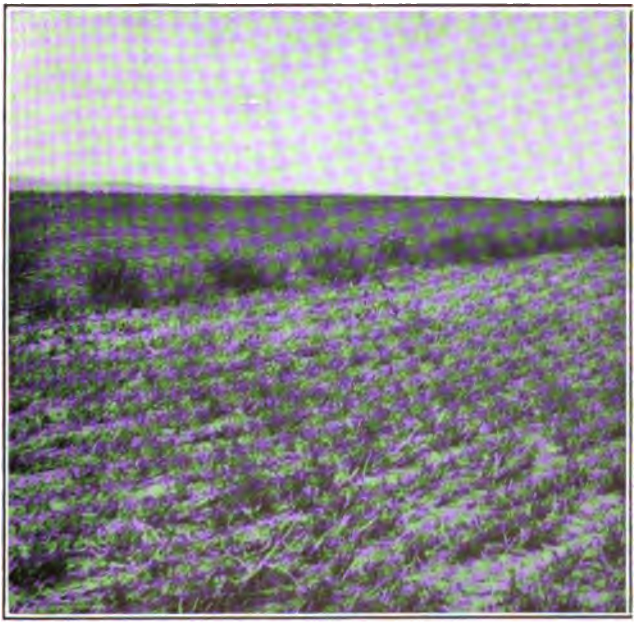

FIG. 2.—THE INTERIOR OF AN ALFALFA PLAT ON THE SAN JUAN COUNTY ARID FARM.

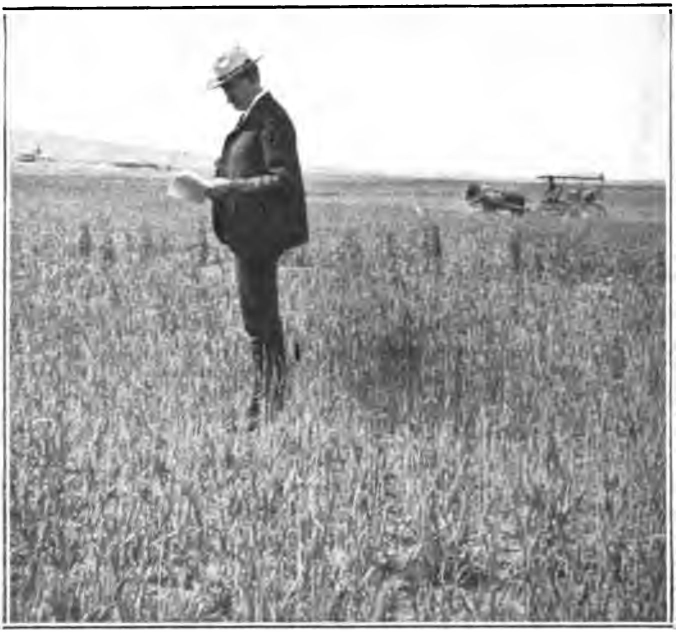

FIG. 1.—A POOR CROP OF WHEAT ON THE SEVIER COUNTY ARID FARM, UTAH.

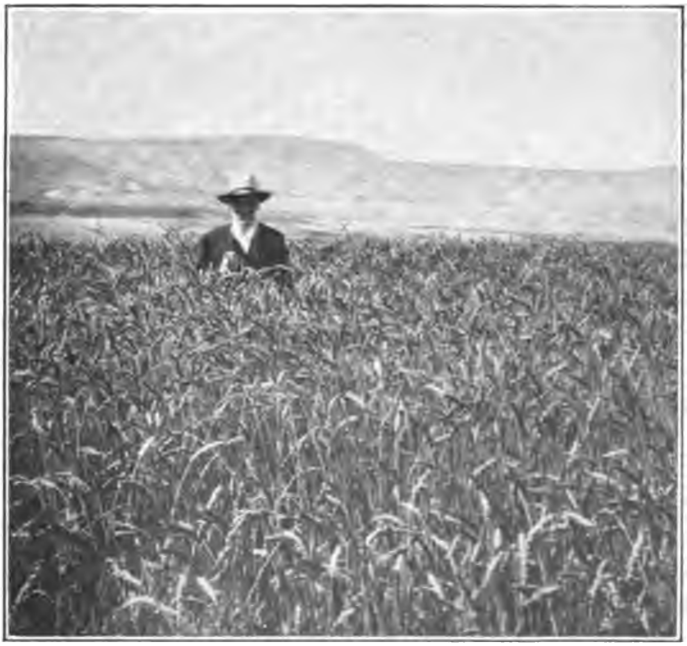

FIG. 2.—A CROP OF WHEAT GROWN WITHOUT IRRIGATION IN THE CACHE VALLEY, UTAH.

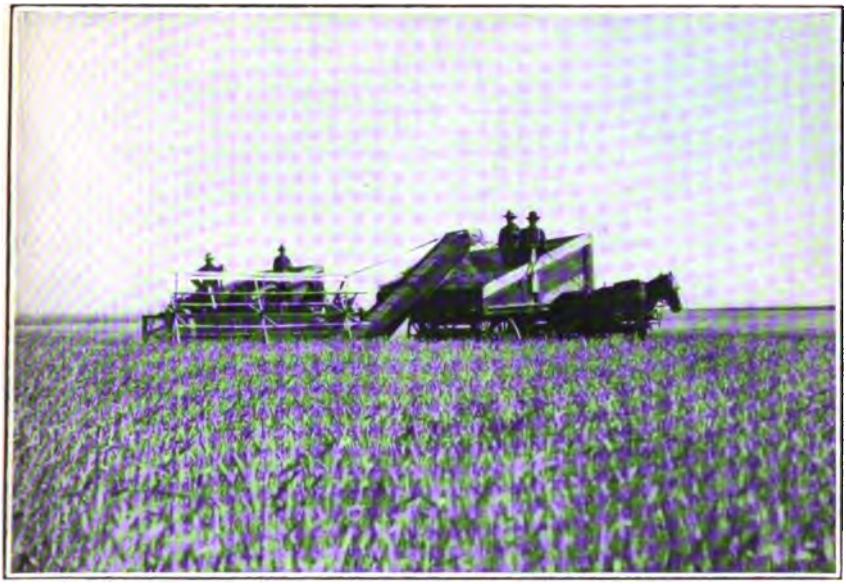

FIG. 1.—HARVESTING WHEAT GROWN WITHOUT IRRIGATION NEAR NEPHI, UTAH.

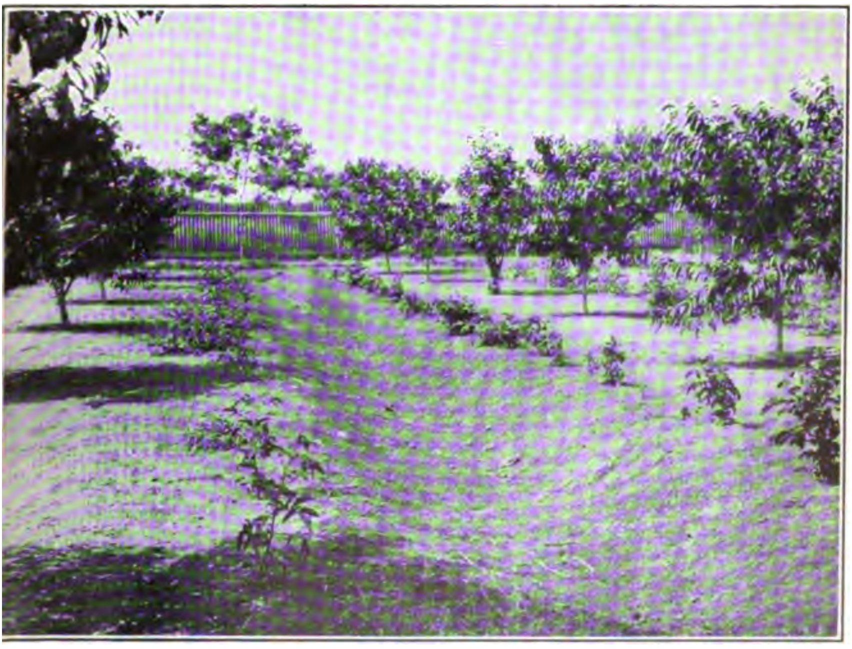

FIG. 2.—A HILLSIDE GARDEN IN A SEMIARID REGION, SHOWING ONE OF THE SETTLING DITCHES USED TO CATCH AND HOLD THE WATER WHICH RUNS OFF THE HILL ABOVE.

INDEX.

Page.

- Africa, North, alfalfa cultivation 29
- Alfalfa area, Utah, 1899 11
    - cultivation, North Africa 29
    - drought-resistant varieties, necessity of breeding 27
    - planting in rows for intertilled crop 30
    - seed production 29
        - quantity to acre, humid and semiarid regions 30–31
    - tillage in dry farming 29–30
- Arid lands, booms, notes 8
    - Utah, experiment farms 14
- *Artemisia tridentata*, occurrence, Great Basin area 10
- Bacteria, soil, nitrogen-fixing 32, 34
- Bear River Valley, dry farming 13
- Cache Valley, Utah, private experiments in dry farming 13
- Cedars, occurrence, Great Basin area 11
- Chrysothamnus, occurrence, Great Basin area 10
- Corn area, Utah, 1899 11
- Cottonwoods, occurrence, Great Basin area 11
- *Covillea tridentata*, occurrence, Great Basin area 11
- Creosote bush, occurrence, Great Basin area 11
- Crop areas, Utah, 1899 11
    - production, necessity of organic matter in soil 33
    - rotation, necessity of intertilled crops in dry farming 12, 17
- Crops, dry farming 27–31
    - intertilled, advantages for preserving soil moisture 12, 17
- Deseret, Utah, precipitation, comparison 21, 23
- Disk plow, use in dry farming 23
- Dry farming, beginning 8
    - development, conditions promotive 7–9
    - experiments, Great Basin 11–15
    - local conditions 15–21
    - pioneer attempts 8–13
    - regions, three principal, west of Rocky Mountains 9
    - supplementary to irrigation 35–36
- Dry lands, home making 36–38
- Durum wheats, experiments in dry farming 27
- Dust mulch, usefulness in dry farming 25
- Experiment farms, arid, Utah 14
- Experiments, dry farming, in Great Basin 11–15
- Fallow, summer, beneficial effects on nitrification 33
    - method in dry farming 24
- Farms, arid, experiment, Utah 14

Pag
Fertility, soil, maintenance without rotation of crops 3
Fillmore, Utah, precipitation, comparison 21-2
Flora, Great Basin area 10-1
Forage crop area, Utah, 1899 1
Garden irrigation on dry lands 3
Grasses, varieties native to Great Basin area 1
Greasewood, occurrence, Great Basin area 1
Great Basin, dry-farming experiments 11-1
    location and topography 9-1
    rainfall, comparison with Great Plains rainfall 16-1
Harrow, disk, use in dry-farming 2
Harrows, drag and brush, use in dry farming 3
Hay, alfalfa, in dry farming 2
    area, Utah, 1899 1
Home making on the dry lands, risks 36-3
Hydrographic survey, necessity in Great Basin 37
Implements used in dry farming 22-2
Irrigated land, Utah, area 13-1
Irrigation, excessive, evil results 36
    garden, necessity on dry lands 37
Jordan River valley, dry farming 13
Lahontan, Lake, drainage center, note 10
Law, arid experiment farms, Utah 14
Levan, Utah, dry farming and location 19
Logan, Utah, dry farming and location 18, 19
Malade Valley, dry farming, note 13
Moisture, soil, methods of retaining 22-27
    necessity of conservation 12, 15
    relation to soil texture 26
Mulch, dust, to conserve moisture, dry farming 25
Nevada crops, areas, 1899 12
Nitrification, conditions favoring 33
Nitrogen fixation, action of soil bacteria 34
Oregon, Great Basin region, note 12
Oxidation, loss of organic matter from soil, remedy by deep plowing 35
Parowan, Utah, dry farming and location 19
Plowing, deep, necessity in dry farming 35
Plows, kinds used in dry farming 22
Potatoes, area, Utah, 1899 11
Precipitation, monthly average at representative points in semiarid West 17, 18
    winter, advantages 16-18
    See also Rainfall.
Rainfall, annual, Levan, Utah, 1893-1906 19, 21
        Logan, Utah, 1893-1906 19
        Parowan, Utah, 1891-1906 19, 22
        Tooele, Utah, 1897-1906 19, 20
    influence of local topography 20-21
    relation to soil moisture 26
Richfield, Utah, precipitation, comparison 21, 23
Rotation, crop, necessity of intertilled crops in dry farming 12, 17
Sagebrush, implements for removing 24
    occurrence, Great Basin area 10
Sarcobatus vermiculatus, occurrence, Great Basin area 11

Page.
Seed, alfalfa, production 29, 30
quantity per acre, humid and semiarid regions 30-31
wheat, quantity per acre, humid and semiarid regions 30-31
Seeding, thin, essential in dry farming 30-31
Semiarid, nonirrigated farm lands, Utah, area 13-14
West, precipitation at representative points 17
Soil, cubic foot, weight 25
fertility, maintenance without rotation of crops 31
moisture, methods of retaining 22-27
relation to rainfall 26
texture, relation to water-holding capacity 25
Soils, dry-farmed, sustained productiveness, causes 31-35
heavy, nonleaching, desirable for dry farming 32
water-holding capacity 26
Steam outfit for plowing compared with use of animals 23
Straw, wheat, plowing under, effect on soil fertility, notes 31-34
Subsoil plowing, dry farming 23
Summer fallow, method in dry farming 24
Tillage, crop, in dry farming 27-31
interseason, methods 22-27
value, lesson of dry farming 36
Tooele, Utah, dry farming and location 19
Topography, Great Basin 10
Traction engine, use in dry farming 22
Triticum æstivum, growing in dry farming 27
durum, experiments in dry farming 27
Utah, arid experiment farms 14
crops and dry-farming practices 12
crops, areas, 1899 11
dry farming, pioneer attempts 8, 13
lake region, dry farming 13
law providing for arid experiment farms 14
private experiments in dry farming 13
Vegetables, area, Utah, 1899 11
Wasatch Mountains, dry farming 13
Water-holding capacity of soil, relation to soil texture 25
Weeds, growth in volunteer wheat 29
Wheat area, Utah, 1899 11
cultivation in dry farming 22
seed, quantity to acre, humid and semiarid regions 30-31
straw, plowing under, effect on soil fertility, notes 31-34
tillage, dry farming 28
varieties, dry farming 27
volunteer, disadvantages 28
yield after fallow years 34
Willows, occurrence, Great Basin area 11

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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 104.

B. T. GALLOWAY, *Chief of Bureau*.

THE PHILADELPHIA
JUL 13 1907
MUSEUMS

THE USE OF FELDSPATHIC ROCKS AS FERTILIZERS.

BY

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U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
OFFICE OF THE CHIEF,
Washington, D. C., March 20, 1907.

SIR: I have the honor to transmit herewith a manuscript containng a review of all the work that has been done up to the present time n the investigation of the use of finely ground feldspathic rocks as fertilizers. There is a constantly growing demand for accurate nformation on this subject, and I therefore recommend that this nanuscript be published as Bulletin No. 104 of the Bureau of Plant Industry.

Respectfully,

B. T. GALLOWAY,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

Page.
Introduction 7
The availability of potash in ground rock 11
The effect of fineness of grinding 26
Cost of ground feldspar 28
Possible harmful effects of ground feldspar 30
Extraction of potash from ground rock 30
Conclusion 31
Index 32

B. P. I.—275.

THE USE OF FELDSPATHIC ROCKS AS FERTILIZERS.

INTRODUCTION.

In view of the great demands that are being made upon the agricultural resources of the country, it is a matter of vital importance that consideration be given to the available supplies of elements which are necessary to sustain and maintain the quality and quantity of the crops. It is well known that there are three principal fertilizing materials: Nitrogen, phosphoric acid, and potash. The discovery of electrochemical and bacteriological processes for fixing the nitrogen of the air, thereby changing it into a form in which it can be used as a plant food, seems to remove all doubt as to the abundance of the supply of this important element for all time to come. An enormous geographical area of this continent is underlain with practically inexhaustible supplies of phosphatic rock, which, with the phosphates obtainable in waste bone, slaughterhouse tankage, fish scrap, and the basic slags from the iron industry, insure a limitless supply of phosphoric acid.

With regard to potash alone there has been reason to feel anxiety. Up to the present time no deposit or source of this necessary element in any of the forms in which it has been heretofore considered available as a plant food has been discovered or developed in this country. The mines of Stassfurt, Germany, furnish almost the entire supply of potash for fertilizer in the United States, exclusive of that which is used over and over by the processes of natural and green manuring. The potash salts, which up to this time have been exclusively used for fertilizing, consist of muriate, sulphate, nitrate, and carbonate, either in a crude or in a previously purified condition. Kainite is a trade name given to a crude product of the German mines, which contains about 13 per cent of actual potash, largely in the forms of sulphate and chlorid (muriate). The quantity and value of potash salt to be used as fertilizers imported in the fiscal years 1903, 1904, and 1905 are shown in the following table. The price of the potash unit has shown a tendency to increase each year.

TABLE I.—*Imports of potash salts for use as fertilizers.*[a]

Kind of fertilizer.	1903.		1904.		1905.	
	Weight.	Value.	Weight.	Value.	Weight.	Value.
	Pounds.	*Dollars.*	*Pounds.*	*Dollars.*	*Pounds.*	*Dollars.*
Crude carbonate	11,130,789	141,033	8,193,872	224,396	7,166,569	218,516
Crude muriate	172,838,780	2,630,457	161,503,785	2,428,480	202,366,601	3,241,152
Crude nitrate	11,946,685	320,082	16,727,175	433,626	14,512,306	386,096
Crude sulphate	45,156,964	782,082	47,592,131	833,954	54,577,670	958,605
Kainite	553,875,840	1,080,393	356,124,160	839,382	539,369,488	1,143,296
Total	794,949,058	4,954,047	590,141,073	4,759,838	817,992,634	5,947,665

[a] Compiled from data furnished by the Bureau of Statistics, U. S. Department of Agriculture.

All of the above salts of potash are readily soluble in water and therefore become quickly available as plant food when applied as fertilizers. On the other hand, the acids with which the potash is combined in these salts, especially in the cases of the sulphate and chlorid, are absorbed only in extremely minute quantities by growing plants. The natural consequence of this is that as the potash is taken away year after year the acid elements collect, in some cases to the great detriment of the soil.

Potash in some form is absolutely necessary to the successful growth of all crops, and is found in varying degrees in the ashes of wood and of vegetable growths of all kinds. This is illustrated in the following table, in which analyses of ashes of a number of vegetables are given. It must be remembered, however, that the amounts of this element found in the ashes of plants vary greatly under different conditions and that the sap of plants frequently absorbs much more of a given element than is actually necessary for its growth. The important point is that potash is an essential plant food of all crops, and particularly of those species which are starch builders.

TABLE II.—*Analyses of vegetable ash.*

Ash.	Phosphoric acid (P_2O_5).	Potash (K_2O).	Soda (Na_2O).	Ash.	Phosphoric acid (P_2O_5).	Potash (K_2O).	Soda (Na_2O).
	Per cent.	*Per cent.*	*Per cent.*		*Per cent.*	*Per cent.*	*Per cent.*
Pea	36	40	1	Cabbage	16	48	4
Bean	30	44	1	Turnip	13	39	5
Potato	19	59	2	Artichoke	16	65	3
Parsnip	18	36	5	Tobacco	15	49	11
Carrot	12	36	13				

We can trace the source of potash in all its forms and wherever found to the igneous rocks which constituted the original crust of the earth. From the averages obtained from the analyses of a large number of crystalline rocks of common occurrence found in this country, Clarke[a] has made the following calculations of the relative abundance of various rock-forming minerals:

	Per cent.
Apatite (phosphate of lime)	0.6
Titanium minerals (oxids and silicates)	1.5
Quartz (silica)	12.5
Feldspar (silicates of aluminum, potash, soda, and lime)	59.0
Biotite mica (silicates of aluminum, magnesium, potash, etc.)	3.8
Hornblende and pyroxene (complex silicates)	16.8
Miscellaneous	5.8
Total	100.0

It is seen from this that probably the majority of all the original rocks contain more than 50 per cent of feldspar. There are, however, a great many different varieties of feldspar. The feldspars belong to a type of minerals known as silicates, in which aluminum and other elements, such as potash, soda, and lime, are combined with silica. Pure orthoclase feldspar is a silicate of aluminum and potash, which theoretically should contain 16.8 per cent of potash (K_2O). As a matter of fact it is extremely difficult to find an example of pure orthoclase, and in most of the feldspars, which occur in large deposits, the potash is to a greater or less extent replaced by soda or lime, or both. For this reason it is impossible to tell without a chemical analysis how much potash any given feldspar will contain. The granite rocks consist of feldspar, quartz, and a little mica in varying proportions; many of the other well-known rocks, such as the slates, sandstones, gneisses, and traps, also frequently contain more or less feldspar. Some of these rocks carry little or no potash, although many of them will run as high as 5 per cent; very few of them run higher than this.

A cubic foot of granite weighs about 170 pounds; on a 5 per cent basis, 8.5 pounds of this is potash. A quarry 100 feet square and 100 feet in depth of such rock would therefore contain 8,500,000 pounds of potash (K_2O). It is at once apparent that nature offers a limitless supply of raw material which only awaits an economical process to make the potash available.

In many localities there occur large dikes or deposits of more or less pure feldspars, which usually run higher in potash than the true granite rocks. These large deposits, which occur in a great many of the States, have been developed in Maine, Connecticut, Pennsylvania, New York, and Maryland, where they have been mined extensively and the feldspar ground to fine powder, principally for use in potteries. As has been said, pure orthoclase feldspar should contain 16.8 per cent of potash (K_2O), but none of these deposits will run on the average much more than 8 to 10 per cent. For pottery use it is essential that the spar should melt in a kiln fire to a clear white glass, and it must therefore be almost entirely free from mica or iron-bearing minerals. For this reason there are large quantities of materials at every feldspar quarry which, though unfit for pottery use, would be valuable if any method were known of making potash available.

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[a] Bul. 228, U. S. Geol. Survey, p. 20.

The question whether fine-ground feldspar can be used as a potash fertilizer has been a matter of controversy for many years. There is a large and widely scattered literature on the subject, an examination of which shows that the matter has been debated with much vigor and sometimes with prejudice and intolerance on both sides. It is easy to find the published records of a number of experiments, made by trained and thoroughly competent agriculturists, which tend to show that ground feldspar is an efficient potash fertilizer. On the other hand, a number of experiments seem to indicate that the potash is only slightly available, while others would appear to show that the ground rock is entirely useless. On account of the large interests involved in the settlement of this question it is not difficult to see why vigorous differences of opinion, and even unjust prejudice, should have arisen. When, however, trained investigators reach opposite conclusions, based upon experimental evidence, we are forced to the opinion that while ground feldspar may be a useful fertilizer under certain conditions it is not so under others.

It is the object of this bulletin to present and discuss as fully as possible all the evidence that can be obtained on both sides of this important question. The great demand for information on the subject which has arisen and the numerous misstatements that have been printed make it desirable to present the evidence obtained up to date, even though many more years will be necessary for the conclusion of careful systematic investigation under crop and field conditions.

The availability of potash contained in feldspathic rock must depend upon several important considerations, which can best be expressed by a discussion of the following questions:

(1) Is the potash locked up in feldspar and the feldspathic rocks, such as granite, gneiss, rhyolite, syenite, etc., to any extent available as a fertilizer when these rocks are crushed or ground to fine powder?

(2) If the first question can be answered in the affirmative, what influence does fineness of grinding have on the question, and to what degree of fineness is it necessary to grind in order to make a sufficient amount of potash available in the first season after application?

(3) What would be the cost of using ground rock in place of the soluble compounds which up to the present time have been exclusively used, and would there be economy in so doing?

(4) Could any subsequent damage result from the use of ground rock; and if so, how would such damage compare with that which follows the continued use of soluble compounds, such as chlorids, sulphates, and carbonates?

(5) If it should be determined that the potash in ground feldspathic rock is only partially available as a fertilizer, is there any method or process by which the ground rock could be treated so as to increase this availability?

THE AVAILABILITY OF POTASH IN GROUND ROCK.

The attention of the writer was first turned to the availability of potash in ground rock by a study of the decomposition which takes place when various rocks are used to form the surface of macadam roads. The binding power of rock dust depends upon the decomposition of the particles under the action of water and other substances. It has always been believed heretofore that only the potash that could be leached or dissolved out of a finely ground material with water was available for plant growth. As a matter of fact even the most finely ground feldspar which it is possible to obtain yields extremely minute quantities of potash to actual solution in water. Feldspar which contained about 10 per cent of potash and was ground to a very fine powder yielded only 0.025 per cent to solution in water, and only 0.036 per cent to the action of a dilute acid. A large number of similar observations has led to the confident belief, almost universally held for many years, that although rocks which were disintegrated by natural processes served as the original source of potash, the action was so slow that it would be useless to grind rocks and attempt to use them as fertilizers. In the writer's investigations, however, evidence has been obtained which seems to show that decomposition of fine-ground feldspar goes much farther than was indicated by the simple solution tests with water and dilute acids. By the use of laboratory methods it has been shown that almost complete decomposition can be made to take place in comparatively short periods of time under the action of water alone. In order to accomplish this result it has been necessary to use a method by which the potash is continually removed as fast as it is set free from its combinations in the rock. Now, as the roots of plants are continually performing this function, it is possible that in nature the decomposition of the feldspathic particles in the soil must be continually going on as long as the product is being used, and slowing down to the stopping point when no removal is effected by plant growth. For further information on the scientific discussion of the decomposition of the feldspars the original papers should be consulted.[a]

The fact, frequently cited and familiar to almost every person, that rocky hillsides with little or no soil can support growths of timber, would appear to demonstrate that rock potash is available. When it is remembered that wood ashes contain anywhere from 5 to 12 per cent of potash, it will be seen that a large tree represents, as it stands, a considerable quantity of this substance. However, trees take a long time to grow, and this present inquiry is mainly confined to availability in a single year from finely ground material.

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[a] Bul. 92, Bureau of Chemistry, U. S. Dept. of Agriculture; Cir. 38 and Bul. 28, Office of Public Roads.

In order to put the availability of the potash in very finely ground feldspathic rocks to actual test the writer undertook some preliminary experiments in the greenhouse. Tobacco was selected for the experiments because, besides being extremely dependent upon an abundant potash supply, this plant is particularly well adapted to observation and control. Artificial soils were made up of clear, close-grained white sand and finely ground feldspar, running about 8 per cent potash, such as is ordinarily prepared for use in the potteries, and which will pass through a standard sieve of about 200 meshes to the linear inch, having apertures approximately 0.0024 inch square. Tobacco seedlings were set out in this mixture and carefully fed from day to day with dilute solutions of ammonium nitrate and ammonium phosphate in order to supply the necessary amount of nitrogen and phosphoric acid. In addition to this, a small amount of salts, containing lime, magnesia, and iron, was also added to the food solutions. Every care was taken, however, to see that no potash, except that which might be supplied by the feldspar, obtained access to the plants.

For the sake of comparison, plants were also grown at the same time in a rich composted loam soil, which contained an abundance of all plant foods, including potash. Although the artificial sand-feldspar soil was hard and apparently unsuited to the growth of plants, the tobacco nevertheless throve well in it, and showed at no time the slightest indication of potash starvation. When the experiments were finally abandoned, the tobacco plants growing in the sand feldspar had attained a height of about 3 feet, and showed every indication of being as perfectly nourished as those growing in the rich soil.

In addition to the above experiments, seedlings were also set out in a poor, unfertilized soil, with and without the addition and admixture of a certain proportion of the ground feldspar. Here also the availablity of the feldspar potash was clearly indicated.

These experiments, which were made in the summer of 1905, were not considered conclusive, but were sufficiently encouraging to justify further and more systematic investigation. Before proceeding it was of course necessary to look up the literature of the subject, in order to see to what extent ground feldspar had been experimented with by other investigators. A bulletin of the United States Department of Agriculture, which appeared a short time after the conclusion of the preliminary experiments described above, contains a partial reference list of previous publications along this line.[a]

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[a] Bul. 30, Bureau of Soils, U. S. Dept. Agriculture, p. 26.

On account of the great interest which has been aroused in this important subject and in order to present all the facts in the most accurate manner, the work of previous experimenters will be given in as much detail as space will permit. It is the intention to bring together all the information and evidence that the literature of the subject affords, whether it appears to be favorable to the use of ground feldspar, or the reverse.

In 1849 Salm-Horstmar[a] published in a German scientific journal a method of preparing an artificial soil which, while being open, porous, and of a soft texture, should be absolutely free from all plant foods except those which were purposely added to it. The purest crystallized sugar was burned to a light form of charcoal and found to be absolutely free from any impurity capable of furnishing nourishment to plants. All sorts of different substances were then added to this material in other pots, and plants grown in them. In this way the experiments were kept under accurate observation and much information was obtained of the actual foods, and their forms, which are necessary to carry on the nourishment of plants. A short time after this investigation, in 1850, a chemist named Magnus[b] repeated these experiments, and also made others. In addition to the pots filled with sugar-charcoal, some of the pots were filled with coarsely pulverized feldspar. It was found that the plants growing in the feldspar made a good growth, even if no other food containing potash was added. The finer the feldspar was ground the better was the development of the plants. Magnus summed up the results of his investigations as follows:

> (1) In the absence of all mineral plant foods, barley attained a height of about 5 inches only before dying.
>
> (2) The addition of very small amounts of mineral plant foods enabled the plants to reach complete development.
>
> (3) If too much plant food was present, the plants were stunted or refused to grow at all.
>
> (4) In pure feldspar barley made complete development and matured grain.
>
> (5) The development of growth varied with the coarseness or fineness of the feldspar.

In 1861 Reichardt,[c] a distinguished agricultural chemist, advanced the opinion that granite, porphyry, and other rocks rich in orthoclase feldspar quickly give up their potash to plants when the particles are very fine.

About 1884 Hensel,[d] a German writer and chemist, advocated the use of ground rock or so-called "stone meal," not only in order to supply the requisite potash, but also the phosphates and other mineral plant foods, such as lime, magnesia, iron, and manganese. This author published a philosophical work entitled "Das Leben," which treated in part of the use of rock fertilizers. Hensel thought that the use of excreta, offal, and other decaying and waste material as manure was harmful, if not to plants, at least to animals and men who subsisted upon them. Like many enthusiasts, Hensel appears to have been completely carried away by his ideas, which were not always justified by known facts. Hensel obtained, nevertheless, a considerable following[a] and factories were established to prepare stone meal. The subject evoked much discussion in Germany for many years. Whether rightly or wrongly, Hensel's ideas provoked the antagonism of nearly all the leading exponents of agricultural science in Germany. A great many experiments were undertaken and in many cases the stone meal as prepared by the factories was shown to be very low in plant foods and nearly worthless as a fertilizer.

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[a] Jour. für Prakt. Chem., 1849, 46, 193.

[b] Ibid., 1850, 50, 65.

[c] Ackerbau Chemie (1861).

[d] A. J. Tafel, Bread from Stones, 1894.

Among the prominent agricultural chemists who waged war on Hensel's stone meal were Wagner,[b] Böttcher,[c] Steglich,[d] Hentschel,[e] Pfeiffer and Hansen,[f] and Morgen.[g]

In some respects Hensel's arguments were not without weight, and he was keenly aware of the necessity for very fine grinding before the mineral constituents of rocks could be considered as practically available. The following quotation[h] from a translation of Hensel's work stands for itself:

> The practical point to settle is how far fertilizing with stone meal pays, what yields it will afford; thus, whether it will be profitable for the farmer to use it. * * * It must here be premised that the fineness of the stamping or grinding and the most complete intermixture of the constituent parts are of the greatest importance for securing the greatest benefit of stone-meal fertilizing. A manufactured article of this kind has recently been submitted to me which showed in a sieve of modern fineness three-fourths of the weight in coarse residuum. But as the solubility of the stone meal, and thus its efficiency, increases in proportion to its fineness, the greatest possible circumspection is required in grinding it. The finer the stone dust the more energetically can the dissolving moisture of the soil and the oxygen and nitrogen of the air act upon it. A grain of stone dust of moderate fineness may be reduced in a mortar of agate perhaps into twenty little particles, and then every little particle may be rendered accessible to the water and the air, and can, therefore, be used as plant food. Thence it follows that one single load of the very finest stone meal will do as much as twenty loads of a coarser product, so that by reducing to the finest dust, the

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[a] Pomol. Monatshefte, No. 1 (1892); also Wegweiser zur Gesundheit, September 15, 1891.

[b] Zeit. Landw. Vereine Hessen, 1894, 64, 14.

[c] Centbl. Agr. Chem., 1895, 24, 363.

[d] Ibid., 1895, 24, 423.

[e] Ibid., 1896, 25, 136.

[f] Ibid., 1896, 25, 802.

[g] Ibid., 1898, 27, 743.

[h] A. J. Tafel, Bread from Stones, 1894, p. 53.

cost for freight and carriage and the use of horse and cart would amount to only one-twentieth. Therefore we can afford to pay unhesitatingly a higher price for the finest stone meal that has been passed through a sieve than for an article that may be not so much a fine powder but rather a kind of coarse sand.

Inasmuch as this bulletin is interested mainly with the inquiry concerning the use of fine-ground feldspar or feldspathic rocks known to be rich in potash, no greater space need be given the German stone meal discussion.

Some experiments were carried out in 1887 on the use of ground feldspar as a fertilizer by Aitken, a Scotch agriculturist, and chemist to the Highland and Agricultural Society of Scotland. Aitken does not say that he was aware of the work of Magnus or the deductions of Hensel. The record of these experiments is given in the author's own words:[a]

> We are familiar with the fact that feldspar, under the slow but constant action of those forces included under the name of weathering, becomes disintegrated and decomposed, and that the potash it contains is dissolved away from it by rain, so that streams emanating from districts where feldspathic rocks abound are found to contain potash salts, and the level straths laid down by the prolonged action of these streams yield fertile soils that are rich in potash. These soils are the product of natural agencies that have been going on for centuries, and the store of soluble potash salts they contain has been increased to an untold extent by the slow solvent action of the roots of plants that have grown on them, so that the conversion of feldspathic rock into soil so rich in potash as to afford an abundant supply of that constituent for the raising of agricultural crops is the product of the work of centuries. At first sight, it might seem a foolish thing to expect that by merely grinding feldspathic rock, and strewing the powder upon soils deficient in potash, the long natural process referred to should be so accelerated as to cause the feldspar to act as a source of potash for the immediate use of the growing of crops whose vigorous growth demands a relatively large amount of that substance. Nevertheless, the striking results of an experiment made at the society's experiment station at Pumpherston showed that such an expectation was not altogether unreasonable. Ground phosphates had been used as a phosphatic manure with varying success for some years, and as it seemed that the varying nature of the results obtained might be due to the varying degrees of fineness to which phosphates were ground, I made a small preliminary experiment, in which the same phosphate was applied in different degrees of fineness, and I found that the more finely ground the phosphate the more effective was it as a manure. A similar experiment on a larger scale is described in the present volume of the Transactions, page 245, where it is seen that the efficiency of ground phosphates is in direct proportion to their fineness. It therefore seemed reasonable to suppose that feldspar, although it is a very insoluble substance, might, if it were ground to an exceedingly fine powder in certain circumstances, be found to yield to the action of the solvents in the soil and in the roots of plants so rapidly as to be available as a source of potash to some crops, even during the short period of a single season.
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> Accordingly I obtained, through Mr. Bödker, the Swedish and Norwegian consul here, at whose instigation the experiment was undertaken, a supply of very

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[a] Trans. Highland and Agr. Soc. Scotland, 1887, ser. 4, 19, 253.

pure feldspathic rock, rich in potash, of which enormous quantities are to be had in Norway. It was ground as finely as possible by Messrs. J. & J. Cunningham, of Leith, and thereafter sifted through a sieve of 120 wires to the linear inch, and was found to contain about 12 per cent of potash. The whole quantity of sifted feldspar was very small, less than a half hundredweight, and as it was received late in the season, the experiment was made simply to afford information which might indicate whether it was desirable to try the experiment on a larger scale the following season. There were two small experiments made—one by Mr. R. Shirra Gibb, at Boon, on a crop of peas, and one at Pumpherston on turnips. The experiments were on plots of one-fortieth acre, and the following were the manures employed and the results obtained:

Kind and quantity of fertilizers.	Peas.		Turnips.
	Dried in bulk.	Grain.	Bulbs.
	Pounds.	*Pounds.*	*Pounds.*
1. Sulphate of potash, 3 pounds Sulphate of lime, 3 pounds Superphosphate, 6 pounds	114	3.8	482
2. Ground feldspar, 12 pounds Sulphate of lime, 3 pounds Superphosphate, 6 pounds	102	3.5	496
3. Sulphate of lime, 3 pounds Superphosphate, 6 pounds	96	....	476

Although the whole experiment is on a small scale, and the crops are below the average, there is nevertheless a clear indication that the feldspar has acted as a potash manure. In both cases where no potash was applied the crop is the smallest. At Boon the plot with no potash was unable to mature its seed, so that it could not be thrashed, while on the other two plots the amount of seed was not very different, and quite in proportion to the total crop, viz, about one-fortieth. The smallness of the crop does not detract from the value of the experiment as a means of indicating whether or not feldspar acts as a potash manure. Had the crop been sown at the proper time it would have been much larger. In the case of the turnip crop the ground feldspar has done better than the sulphate of potash. That may be accidental, but it may be that the insoluble form in which potash is contained in feldspar is more favorable for turnip growing than the soluble sulphate. Soluble potash manures, when applied to the turnip crop, sometimes diminish rather than increase the crop, and this is especially the case where the crop is dunged in the drills; but no dung has been put on the Pumpherston station these twelve years, and the results obtained all over the field show that potash is now required for turnip growing on that land.

Upon the whole, the result of this experiment may be taken as showing that potash feldspar when ground to an exceedingly fine powder is capable of acting as a potash manure even in a single season.

In 1889 the Maine State experiment station,[a] under Balentine, independently of any previous experimenters, investigated the use of ground feldspar as a source of potash on oats. The results are given verbatim from the records of the station:

In connection with the experiments with finely ground phosphatic rock as a source of phosphoric acid for plants, pot experiments have been undertaken to determine to what extent plants can avail themselves of the potash of potash feldspars. The pots used for the experiments were like those used in the phosphate experiments. They were also filled in the same manner, having first a layer of gravel at the bottom and above this 65 pounds of quartz sand, with the last 35 pounds of which were mixed the experimental fertilizers.

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[a] Ann. Rept. Maine State Col. Exp. Sta., 1889, p. 143.

Three pots, 1, 5, and 9, were supplied each with 10 grams of feldspar carrying 11.61 per cent of potash, 10 grams of nitrate of soda, and 10 grams of acid South Carolina rock. Three other pots, 13, 17, and 20, were fertilized with 20 grams of feldspar and the same amount of nitrate of soda and acid phosphate as was supplied to 1, 5, and 9. In these pots were planted oats. When the oats were 2 or 3 inches high they were thinned out to 18 plants per pot. The pots were watered in the same manner as were those in which the experiment with phosphates was conducted.

In the table below are shown the results of substituting muriate of potash for feldspar as a source of potash:

Kind and quantity of fertilizers.	Number of pot.	Yield of grain, in grams.	Yield of straw, in grams.
10 grams feldspar	1	18.37	47
10 grams nitrate of soda	5	14.37	43
10 grams acid South Carolina rock	9	19.43	47
20 grams feldspar	13	17.28	47
10 grams nitrate of soda	17	16.78	47
10 grams acid South Carolina rock	21	16.83	52
3 grams muriate of potash	16	22.88	67
10 grams nitrate of soda	20	18.85	72
10 grams acid South Carolina rock	24	24.37	65

The pots receiving 10 grams of feldspar produced, on the average, about 79 per cent of the average of the grain produced by those pots receiving 3 grams of muriate of potash having 50 per cent of actual potash. The amount of grain was not increased by increasing the feldspar to 20 grams, though there was a slight gain in straw.

The conclusion to be drawn from the experiment is that the oats were able to draw from the feldspar potash enough for a large crop of grain. If this conclusion is verified by future work, some of our feldspars may prove a cheap source of potash to the farmers of the State.

Examination of the figures given in the above table shows that the potash from the feldspar undoubtedly became available, but was not as efficient as that from the more soluble muriate.

In 1889, the same year that the results of these experiments were made public, Nilson[a] in Sweden published an investigation in which fine-ground feldspar prepared for the potteries was tested in comparison with potassium sulphate. Oats were used, and the experiments were carried out on the Swedish moor soils, which, in a dry condition, already contained 0.5 per cent of potash, although only 0.03 per cent of this was soluble in dilute acid. There were 300 kilograms (660 pounds) of slag phosphate, 50 kilograms (110 pounds) of nitrogen in the form of Chile saltpeter, and 80 kilograms (176 pounds) of potash as sulphate or 200 to 300 kilograms

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[a] Landtbr. Akad. Handlingar och Tidskr., 1889. See also Centbl. Agr. Chem., 1889, 18, 608.

(440 to 660 pounds) as ground feldspar added to the hectare (2.47 acres). The results of weighings of crop yield, made on the basis of 100 plants from each trial, are given in the following table:

Weight of crop of oats from seven plats of 100 plants each, grown with various fertilizers.

Kind of fertilizer.	No.	Grain.	Straw.	Chaff.	Total.	Equivalent yield of grain per hectare.
		Grams.	*Grams.*	*Grams.*	*Grams.*	*Kilograms.*
Unfertilized	1	5.3	11.0	1.0	17.3	216
Phosphate and potassium sulphate	2	157.3	220.5	16.3	394.1	6,400
Phosphate and 300 feldspar potash	3	133.8	178.7	15.5	328.0	5,450
Phosphate and Chile saltpeter	4	175.5	242.8	21.2	439.5	7,150
Phosphate, Chile saltpeter, and potassium sulphate	5	232.5	346.2	24.8	603.5	9,470
Phosphate, Chile saltpeter, and 200 feldspar potash	6	171.5	245.2	21.3	438.0	7,000
Phosphate, Chile saltpeter, and 300 feldspar potash	7	177.7	262.5	23.5	463.7	7,240

Nilson's results are most unfavorable to ground feldspar, as an inspection of the figures shows, but as a very good yield was obtained by the use of Chile saltpeter and phosphate without any additional potash, the experiments are not very conclusive. Chile saltpeter is a crude nitrate of soda which sometimes contains potash salts. It is possible that in all these experiments there was a tendency to overfeeding rather than to underfeeding.

In 1890 Sestini[a] published the results of a very interesting investigation of the decomposing action of plant roots on feldspar. A coarse feldspathic granite sand from the island of Elba was first carefully washed to remove all adherent earth or plant food, and then mixed with certain amounts of carbonate, phosphate, and sulphate of lime. The nitrogen was supplied in the form of ammonium nitrate. Various plants and grasses were grown in this mixture under very careful test conditions. The crops matured well, and at the end of about a year it was shown that a very considerable decomposition of the feldspar had taken place. Sestini concluded that the decomposition of the feldspar went on much more rapidly under the influence of plant growth than had previously been supposed.

In 1901 Headden,[b] working at the Colorado experiment station, also independently, carried on some interesting experiments on the availability of potash contained in ground feldspar. To quote this author's own words:

> We endeavored to determine whether the feldspar could furnish potash to plants. For this purpose the perfectly fresh mineral was used, pulverized as already described in imitation of the soil, i. e., the particles varied from

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[a] Landw. Vers. Stat., 1900, 54, 147.

[b] Bul. 65, Colorado Exp. Sta., p. 30.

1 millimeter in diameter to an inpalpable powder. This was mixed with pure quartz sand. Bone ash was used to supply lime and phosphoric acid. The sample used contained no potash. Nitrate of lime furnished the nitrogen. Chlorine was furnished by a minute quantity of calcic chloride. Distilled water was used throughout the experiment.

The plants grew healthily in this mixture until the floors of the building were oiled and the room in which the plants were growing was shut up and became too warm; these two things together gave them a decided setback, and later a thrips, *Thrips striata* according to Professor Gillette, attacked the plants and did them much damage. Some of the plants, however, seeded. They were harvested, though in bad condition and very uneven in the degree of their development. The root system was well developed, the sand being filled with the roots. The weight of the tops as harvested was 198.5 grams; that of the roots as washed out was 40 grams. The tops and roots were incinerated together and yielded 5.795 per cent of soluble and 9.803 per cent of insoluble ash, a total of 15.598 per cent.

Examination of the feldspars used showed the presence of 11.993 per cent of potash and 2.988 per cent of soda. Phosphoric and sulphuric acids were present in very small quantities; the former equaled 0.041 per cent and the latter 0.003 per cent of the feldspar.

The nitrogen in the oat hay, roots included, was 3.2543 per cent.

The ash gave the following analysis:

	Per cent.		Per cent.
Carbon	0.17	Calcic oxide	21.70
Sand	8.13	Magnesic oxide	3.90
Silicic acid	15.73	Ferric oxide	.96
Sulphuric acid	4.41	Aluminic oxide	.31
Phosphoric acid	3.98	Manganic oxide	.16
Carbonic acid	15.35	Ignition	2.61
Chlorine	2.73		
Potassic oxide	15.95		100.71
Sodic oxide	4.62		

This ash is very anomalous in its composition as well as in the quantity present in the plants. The plants were not evenly matured at the time of gathering and were in bad condition. The question we endeavored to investigate, however, is perfectly answered by the results, i. e., the oat plant can use the finely divided feldspar as a source from which to obtain potash, for in this experiment, made under very adverse conditions, we found that the oat plants took from the feldspar 1.4417 grams of potash. The potash added in the seed has been deducted. The silicic acid appropriated by the plant indicates the decomposition of the silicate.

In 1905 Prianischnikow,[a] a Russian investigator, published the results of a series of pot tests using feldspar and mica as sources of potash. The feldspar used was ground so that it was less than 0.25 mm. in diameter, corresponding to an 80-mesh sieve. The material was mixed with sand and the other foods added in the form of phosphates and nitrates of lime and soda. The cultures used were tobacco, buckwheat, flax, peas, sunflowers, and barley. The tabulated results are too voluminous for insertion here, but they appear to show that the feldspar, even in large amounts, had little or no effect on the growth of the plants. The investigator concluded that mica is, if anything, a better source of potash than feldspar, but that neither of these minerals supplies a sufficient quantity to make them worth the slightest consideration so far as plant growth is concerned. The only criticism of these experiments that might be offered is that 80-mesh feldspar powder is far too coarse to be used in pot experiments. This point will be taken up more fully later on.

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[a] Landw. Vers. Stat., 1905, 63, 151.

The most important researches which have ever been published tending to show that under certain conditions finely ground feldspar is worthless as a fertilizer are those of von Feilitzen.[a] This experimenter, like Nilson, worked on Swedish moor soils. He concluded that ground feldspar is almost worthless as a fertilizer. The results and conclusions are best shown by abstracting from a translation from von Feilitzen's publications:[b]

> Potash, as is well known, is one of the necessary constituents of plant food; consequently, if it is absent in the soil or only there in insufficient quantities, a normal development of the higher orders of plants is not possible. According to the researches of plant physiologists, it is particularly instrumental in the formation and transport of the carbohydrates (sugar, starch, etc.), for which reason potash plays such a prominent part in the manuring of potatoes, turnips, and other root crops, but it is also required for cereals and all the other cultivated plants. Of late, comprehensive experiments have been carried out by Prof. Dr. H. Wilfarth at the experimental station at Bernburg, with the view to ascertain in what way the want of one or several of the necessary constituents of plant food influenced the development and appearance of plants. On this occasion he found that the want of potash caused a defective growth of some of the vegetative parts, the leaves of potatoes, tobacco, buckwheat, and beetroots assuming a speckled appearance.[c] Certain clearly defined portions, especially at the borders of the leaves, grew yellowish-white and decayed, while the other parts retained their original appearance. These marks are often very much like those caused by fungi and insects, but if examined more closely it becomes evident that they can not be due to such causes.
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> In 1903 we made quite similar observations, when experimenting with clover and timothy grass, and, as it should be of interest, I shall describe in short the observations made by us. In 1902 a series of experiments were prepared in plots of soil of 1 square meter each (about 1 yard square), charged with rather well-decayed reed grass turf, poor in potash, in order to investigate whether the potash in a mineral fertilizer, prepared in Sweden, was of any manurial value. As, by analysis, this fertilizer turned out to be finely ground feldspar, we were prepared for an unfavorable result at the very outset.

The fineness of the ground feldspar is not given, but an analysis showed that it contained 8.15 per cent of potash. The experimental series was made up of two plats, each fertilized as shown in the following table, and in May, 1902, they were sown with a clover-grass mixture containing red clover, bastard clover (alsike), white clover, and timothy grass. Even in the first year the grass developed vigorously and produced vegetable matter, as shown in the table. An average of 1 square meter of each of the two parallel plats was taken. Fifty-four pounds of phosphoric acid were used on each plat.

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[a] Exp. Sta. Record, U. S. Dept. Agriculture, 1904, 16, 30.

[b] How Deficiency in Potash Affects Clover and Timothy.

[c] Jour. für Landw., 1903, No. 11.

Plat number.	Kind and quantity of fertilizer per acre.	Green vegetable matter produced—average of 2 plats.	Increase due to potash—average of 2 plats.
		Pounds.	*Pounds.*
1	Without potash and with 857 pounds of basic slag	1.20	....
2	With 89 pounds of potash as potash manure salt	4.58	3.83
3	With 89 pounds of potash as ground feldspar	1.69	.49
4	With 178 pounds of potash as ground feldspar	1.96	.76

These figures show that this soil responded very well to the application of the soluble potash salts. While it must be admitted that the ground feldspar was somewhat available, the effect appears to have been inconsiderable.

It is hard to reconcile such contradictory results as these which are given at length in the preceding pages. The only thing that can be said at the present time is that careful and systematic tests are required in order to determine finally to what extent and under what conditions ground feldspar can be economically used in agriculture. The inference to be drawn would seem to be that under certain conditions finely ground feldspar is at least partially decomposed, so that its potash becomes sufficiently available to be made use of by certain crops. Under other conditions we are forced to the conclusion that ground feldspar is of little value as a potash fertilizer.

Before proceeding with the description of experiments carried on by the Department of Agriculture it will be necessary to define, as briefly as possible, total and available potash, as the terms are commonly used. Potash is the name given to the oxid of the metallic element potassium. The name is derived from the fact that potash at one time was principally obtained by leaching wood ashes in large iron pots. The letter K is used by chemists as the symbol for potassium, the German name for which is Kalium. The oxid is written K_2O, which signifies that two atomic weights of potassium unite with one atomic weight of oxygen to form potash. Potash as such is a strongly caustic substance which unites with water to form a compound technically known as lye. Fertilizers, both natural and artificial, contain potash, invariably combined with some acid to form a compound or salt, such as sulphate, chlorid, carbonate, nitrate, phosphate, or silicate. Although potash (K_2O) does not exist free in a fertilizer, the potassium present in whatever form is figured and reported as total potash (K_2O). Owing to the belief that has always been held by the majority of chemists and agriculturists that the potash combined as it is in the mineral silicates becomes soluble with extreme slowness, if at all, it is customary to distinguish between available and total potash. According to the official methods in vogue in this country the available potash is determined by boiling 10 grams of the sample with 300 grams of water thirty minutes and analyzing the water extract. In different places different methods are used; in some cases acid solutions are used to extract with, so that it is difficult to give an exact definition of available potash. However, it may be defined as all the potash that is present, in whatsoever form, which the crop can make use of in one crop season. The text-book definitions, as well as the State fertilizer laws, are in need of revision in this particular respect. This is especially true in view of the fact that the value of a mixed fertilizer is figured, as far as potash is concerned, on the available or water-soluble potash alone. Even the potash contained in such organic fertilizers as cotton-seed meal and tobacco stems, which undoubtedly becomes available in one season, is not estimated as being available by the present methods of analysis, and therefore in many cases great injustice is done to manufacturers of mixed fertilizers, who should certainly be entitled to all the plant food contained in their mixtures which can be made use of by a crop in a single growing season.

Tobacco is particularly dependent upon abundant supplies of potash. In some of the tobacco-growing districts barnyard and stable manures are used, often enriched with an addition of commercial fertilizers. Since sulphates and muriates of potash are found to be harmful in certain ways to high grades of tobacco, the use of the strongly alkaline potassium carbonate has been largely resorted to on the tobacco crop. Potassium carbonate, which contains about 66 per cent of potash (K_2O), is an expensive compound, costing $90 to $95 per ton, f. o. b. port of entry, or 6 to 7 cents per pound of unit potash. In addition to the cost of this salt, its strong alkalinity is an objectionable feature, and it is a grave question whether the annual addition to the land of a superabundance of such an alkaline salt will not be followed by an actually harmful effect. In view of the successful results which have attended the efforts of the Bureau of Plant Industry[a] to improve the quality and yield of native tobacco by proper selection and breeding, it was decided to make a systematic investigation of the possible use of ground feldspar as a potash fertilizer.

Preliminary to the field and crop experiments which were to follow later, greenhouse experiments were begun early in the winter of

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[a] Bul. 96, Bureau of Plant Industry, U. S. Dept. of Agriculture; Yearbook Dept. Agr., 1905, p. 219.

1905–6. Three large beds in the greenhouse, all having the same dimensions ($21\frac{3}{10}$ feet by $6\frac{2}{3}$ feet by 5 inches), were filled with a common unfertilized meadow soil taken from the surface after the removal of sod and grass roots. Four pounds of ground bone phosphate were broadcasted and well worked in.

Bed No. 1 now received 2 pounds of potassium carbonate containing about 67 per cent of potash (K_2O). In order that the potassium carbonate might be evenly distributed, it was dissolved in 2 gallons of water and sprinkled evenly over the bed. After drying out, the earth was again well worked.

Bed No. 2 received 17.4 pounds of finely ground potter's feldspar containing 8.3 per cent of potash (K_2O). This was also broadcasted and well worked in. It will be seen that beds 1 and 2 contained nearly equivalent amounts of potash, the only difference being that in one case the soluble carbonate was used and in the other ground rock.

No potash in any form was added to bed No. 3, which was used for comparison. The soil itself, however, contained about 0.5 per cent of total potash, and as the filtered Potomac River water which it was necessary to use for watering throughout the entire experiment contains an amount of potash equal to about 2 parts per million, the tobacco on bed No. 3 did not at any time show the effect of potash starvation.

All three beds were supplied with a sufficient quantity of nitrogen in the form of pure ammonium nitrate. The seed chosen for the experiments was carefully selected Cuban wrapper tobacco. In making experiments of this kind it is necessary to select seedlings as nearly as possible of equal vigor. It is not improbable that many wrong deductions have been drawn from pot or plat experiments in which the need for careful selection of seed has been overlooked.

Tobacco seedlings were set out in four rows of ten plants each in the three beds. The tobacco crop is usually planted with about 8,000 plants to the acre, so that the experimental plats represented, as far as plant growth was concerned, one two-hundredth of an acre. The actual amount of potash added to plats Nos. 1 and 2 was equivalent to 280 pounds to the acre. As the original soil contained a sufficient amount of potash to mature some sort of a crop on plat No. 3, it is not possible to state the actual amount of potash present in the three plats. The potash in the soil was not water soluble and would not have been termed available in the present sense of the word.

The tobacco grew well throughout the experiment, and for the first six weeks very little difference was noted. After this time, however, it became evident that the plants in plat No. 3 were falling behind. At the end of twelve weeks the plants in plat No. 3 were plainly stunted and much less developed than those in the other two plats. The tobacco grown in plats Nos. 1 and 2 was evenly developed, fully matured, and of a good quality. It was carefully harvested in the usual way and the yield of green tobacco weighed. After curing, the actual yield of leaf was also recorded. The results, which are shown in the following table, appear to indicate that the feldspar potash was available to quite the same extent as that which was added as potassium carbonate:

TABLE III.—*Results of greenhouse experiments with tobacco plants.*

No. of plat.	Source of potash.	Actual weight of green crop.	Estimated weight of green crop per acre.	Actual weight of cured leaf.	Estimated weight of cured leaf per acre.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
1	Potassium carbonate	154.0	30,800	5.70	1,140
2	Ground feldspar	155.0	31,000	6.30	1,260
3		128.5	25,700	5.30	1,060

These yields do not in any case equal those obtained in the field under the best crop conditions, but for a winter greenhouse crop raised in shallow beds they are satisfactory.

On the completion of the greenhouse experiments arrangements were made to carry on field trials in Connecticut and Florida under standard crop conditions. In the tobacco-growing district of Connecticut it is customary to use from 150 to 250 pounds of carbonate of potash to the acre of tobacco. The cooperation of several prominent tobacco growers was obtained, who each agreed to try an acre, substituting for the usual carbonate 1 ton of potter's spar, running 8.3 per cent of potash, or 186 pounds to the ton. The broadcasting and working in of the feldspar was done under the personal supervision of representatives of the Department of Agriculture, and none of the experimental acres received any potash except that contained in the ground spar. All the experimental fields did as well as any in their neighborhood and matured excellent crops. The following letters were received from the growers themselves in regard to the use of feldspar:

TARIFFVILLE, CONN., *February 11, 1907.*

DEAR SIR: In reply to your letter of February 5, I would say that I used the ton of finely ground feldspar as a potash fertilizer for tobacco, and used no other form of potash on the plat in connection with the feldspar. This plat (one-half acre) was treated exactly like the rest of our tobacco lands as regards nitrogen, phosphoric acid, lime, etc.

We had a fine large growth of tobacco where the feldspar was used; fully as large as any in our fields, and much larger than in some sections of our fields.

I do not consider this an absolute or hardly a fair test of the feldspar, as it was used on land that had previously grown tobacco for several years, and each year we had fertilized heavily with carbonate of potash. I will be pleased to give you more detail if you wish.

Yours respectfully, J. S. DEWEY.

HARTFORD, CONN., *February 7, 1907.*

DEAR SIR: In reply to your letter of February 5 regarding the finely ground spar, would say that we used this material as a potash fertilizer as directed by you last spring. This was used on comparatively new land, tobacco having been grown only one season previous to this past season. During the growing season we could not see any perceptible difference on the same land between this tobacco and that treated with carbonate of potash, planted side by side. We hung this tobacco in the same shed, it being cut at the same time, where we were able to identify it after it was cured. We are glad to report that the tobacco grown where the ground feldspar was used was exceptionally nice tobacco. It was so pronounced by tobacco experts who have examined it.

The tobacco grown on the same character of land beside where this was grown was exceptionally nice tobacco, but we think if there was any preference it would be for that grown on the feldspar. It certainly was beautiful in every respect. We should be very glad to conduct an experiment on 1 acre or less on new land that has never grown crops of any kind or been fertilized in any way by stable manure or other fertilizer, and follow this up for, say, three years. We have a piece of land we think well adapted to make the experiment. The result this past year has been so gratifying that we would be very glad to carry it a little further, if possible.

Any further information we can give you we will be glad to furnish.

Yours truly, OLDS & WHIPPLE.

SUFFIELD, CONN., *February 16, 1907.*

DEAR SIR: Yours received inquiring about the finely ground feldspar sent me. Would say that I used it on 1 acre of tobacco and got very satisfactory growth. The only difference I could detect in tobacco grown on this acre and the adjoining land, where I used cotton-hull ashes for potash, was that the burn of the tobacco grown on the latter was not quite as clear as that of the tobacco grown on the feldspar.

Yours respectfully, EDMUND HALLADAY.

QUINCY, FLA., *March 7, 1907.*

DEAR SIR: In reply to your favor, I beg to state that 1 acre of tobacco was grown here last year on ground feldspar, and as far as we were able to tell from the appearance of the tobacco in the field the growth was equally as good as where other forms of potash were used. Mr. Underhill, who used this feldspar, was not able to harvest the tobacco separately on account of scarcity of labor in harvest season.

I am planting some plat experiments this year in which I have included the ground feldspar, to be compared with other forms of potash, and hope to get some information in this way. In addition to this I shall put out at least 2 acres of feldspar as a substitute for carbonate of potash, and will report results at the end of the season.

Yours very truly, W. W. COBEY.

Although it is admitted that these experiments have not as yet proved the value of ground feldspar for tobacco, it is quite certain that the experimental crops found all the potash they required. If we assume that von Feilitzen and others are right and that the feldspar is of little or no value, we must conclude that the practice of adding potassium carbonate each year to the tobacco fields is unnecessary.

Many attempts have been made by the writer to devise crucial tests which would show decisively whether or not the ground feldspar is actually capable of giving up potash to growing plants. One of these experiments, which was undertaken in cooperation with Dr. L. J. Briggs, of the Bureau of Plant Industry, is interesting on account of its direct bearing on this point. A wooden trough of 1 square foot cross-sectional area and 30 feet in length was filled with a poor meadow soil, containing no appreciable quantity of water-soluble potash. About 5 pounds of fine-ground feldspar, containing 9.3 per cent of total potash, was then evenly distributed over the surface of the trough and well worked into the soil. Carbon electrodes of about 1 square foot area were inserted at the extreme ends and tobacco seedlings set out at 1-foot intervals along the trough. The carbon electrodes were connected to a 110-volt direct-current lighting circuit and a current of electricity was passed continuously in the same direction through the soil while the growth of the plants was in progress. The amount of current varied with the moisture content of the soil—between the limits of 5 and 15 milli-amperes. The plants made a flourishing growth, and at the end of several weeks it was apparent that the best growth was being made in the neighborhood of the center of the trough, the plants at the extreme positive and negative ends being more or less stunted. The soil at the beginning of the experiment was neutral to litmus paper. At the end of the experiment, when the plants had attained a maximum height of 2 feet, a sample taken from the positive end of the trough reddened litmus paper, showing it to be decidedly acid. The middle section by the same test was shown to be faintly and the negative end strongly alkaline. While no sweeping deductions can be drawn from the single experiment, it is quite certain that a partial transference of the alkaline bases from the positive to the negative end of the trough had occurred. This effect could only take place with that portion of the bases which had actually passed into solution. The results of this experiment appear sufficiently interesting to warrant repetition under still more careful conditions.

THE EFFECT OF FINENESS OF GRINDING.

From the evidence which has been submitted in the preceding pages it may be safely concluded that the potash contained in ground feldspar is at least in some part available as plant food. The question whether it can be made sufficiently available under certain conditions to be an economical substitute for concentrated and soluble potash salts remains to be determined by systematic investigation. It may have been noticed in reading the account of the foregoing experiments that in only a few cases was the fineness of the feldspar material described. Each investigator considered ground feldspar fine material, whether it passed an 80-mesh or a 200-mesh sieve. A standard sieve containing 200 meshes to the linear inch has openings 0.0026 inch square. A sieve of 80 meshes to the linear inch has openings about 0.007 inch square. It is never the case, however, that a material which has been ground so that it will just pass a certain sieve will consist of particles of uniform size corresponding to the size of mesh. All ground material contains a certain proportion of very fine particles, down to those which might be characterized as submicroscopic in size. The smaller the coarser particles of a given powder which has been ground in bulk the higher will be the proportion of very fine material. This is a very important point, because it is doubtless true that the amount of decomposition caused by the action of water on ground feldspar is directly proportional to the active surface area presented by unit weights of the powder. To one who has not studied the matter, the rapidity with which surface area rises with fine grinding is very surprising. In a 200-mesh feldspar powder, such as is supplied by the grinder for the pottery trade, the finest particles bear the same relation to the coarsest present as these latter would to fragments about 2 inches in diameter. As the surface area of a powder increases in inverse ratio to the diameter of the particles, it can be seen how quickly the availability due to active surface must increase with fineness in grain. No one would for an instant consider the possibility of fertilizing land by scattering on it feldspar fragments of an average diameter of 2 inches. Yet in grinding these fragments to an 80-mesh powder, we have not increased the active surface area as much as we should do by pushing on the grinding of an 80-mesh powder to the ultimate fineness attainable in mechanical processes. Grinding is making surface, and it can be shown that the availability of potash in ground feldspar increases with the surface area. If feldspar is ground so that it will pass an 80-mesh sieve, it will of course contain a certain proportion of very fine particles, some of which approach the limits of visibility under a powerful microscope. If we carry on the grinding of the material from 80-mesh to 200-mesh, the proportion of the very small particles is enormously increased. The smallest particles which we need to consider here are those which can be measured by a micrometer device connected with the microscope. These smallest particles have a diameter of about 0.0001 millimeter. Now, in order to make a specific example, we will consider the surface areas presented by 1 pound of feldspar in different degrees of subdivision. First, in the form of a solid cube, then broken down to particles that could just pass an 80 and a 200 mesh sieve, respectively, and, finally, in the condition it would be if it were possible to grind all the material as fine as the finest particles which occur in an ordinary 200-mesh powder. The 1 pound of feldspar in a solid cube would have a surface area of 29.3 square inches; particles capable of passing an 80-mesh sieve would give 8,870 square inches; particles able to pass a 200-mesh sieve would give 24,905 square inches; and if it were possible to reduce the powder to particles 0.0001 millimeter in diameter, there would result a surface area of 16,460,000 square inches.

If it were practically possible to collect 1 ton of feldspar all in the state of the finest particles, as shown above, the surface area presented by the ton would be enormous—in fact, it would be equal to 256,000,000 square feet, 5,877 acres, or more than 9 square miles. Now, although such grinding is out of the question at the present time, an ordinary 200-mesh feldspar prepared for the pottery trade, which is valued at about $8 per ton, contains a large proportion of very fine particles. The marvelous rise in the surface area attained by fine grinding is very well exhibited in the figures given, and it is undoubtedly true that previous experimenters have not paid sufficient attention to the percentage of very fine material in the ground feldspar.

One opponent of the use of feldspar has written:[a]

> What we call soil is rock of various sorts crushed or broken up by weather and other agencies. The crushed granite could hardly be more fertile than a good soil. When we think that an acre of soil 1 foot deep weighs over 3,500,000 pounds, we see what a drop in the bucket a few tons of ground rock really amounts to.

As a matter of fact, discussion of the value of a few tons of fine-ground potash-bearing rock, with its millions of square feet of surface area, can not be so easily brushed aside. It is true that the soil contains many fine particles; but those which, like feldspar, suffer decomposition under the action of water have presumably been already decomposed, and this new material is to replace that which has been used up or removed. Each tiny particle of feldspar provides only a small increment of potash, but in a ton of fine-ground material there are many billions of particles.

COST OF GROUND FELDSPAR.

Nearly all of the feldspar which is at present ground to fine powders is prepared, as has been stated, for the pottery trade. For this purpose it is necessary to use mills with specially adapted linings so that the finished product shall not become contaminated from the contact with iron or steel. The production and cost of feldspar, mainly for the use of the potteries, during five consecutive years, is shown in the following table:

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[a] The Potash in Crushed Rock, German Kali Works, New York.

TABLE IV.—*Production and value of feldspar, 1901–1905.*[a]

[Short tons.]

Year.	Crude.		Ground.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
1901	9,960	$21,669	24,781	$198,753	34,741	$220,422
1902	21,870	55,501	23,417	194,923	45,287	250,424
1903	13,432	51,036	28,459	205,697	41,891	256,733
1904	19,413	66,714	25,775	199,612	45,188	266,326
1905	14,517	57,976	20,902	168,181	35,419	226,157

[a] Mineral Resources of the United States, U. S. Geol. Survey, 1905.

For fertilizer purposes the fine grinding of feldspar could be done in iron mills similar to those which are used for grinding limestone in the cement industry. The only important points to consider would be the percentage of total potash present and the fineness of grinding. At the present time there are few data available on the cost of grinding feldspar to a 200-mesh powder, but with modern machinery there is little doubt that it can be done much more economically than would have been considered possible only a few years ago. Under the stimulus of the cement industry a great development has been made in recent years in the methods and art of fine grinding. The following table is of interest, as it shows at a glance what the potash in ground feldspar would cost if the percentage is compared with a cost of grinding varying from $1 to $10 per long ton.

TABLE V.—*Price per pound of potash unit in feldspar.*

Potash contained in the feldspar.	Cost of ground feldspar per ton (2,240 pounds).									
	$1.	$2.	$3.	$4.	$5.	$6.	$7.	$8.	$9.	$10.
3 per cent	$0.015	$0.030	$0.044	$0.059	$0.074	$0.089	$0.104	$0.119	$0.184	$0.149
4 per cent	.011	.022	.033	.044	.055	.067	.078	.089	.100	.111
5 per cent	.009	.018	.027	.035	.044	.053	.062	.071	.080	.090
6 per cent	.007	.015	.022	.030	.037	.045	.052	.059	.067	.074
7 per cent	.006	.012	.019	.025	.032	.038	.045	.051	.057	.063
8 per cent	.005	.011	.017	.022	.028	.032	.039	.045	.050	.056
9 per cent	.005	.009	.014	.019	.024	.029	.035	.039	.044	.049
10 per cent	.004	.009	.013	.018	.022	.027	.031	.035	.040	.045
11 per cent	.004	.008	.011	.015	.020	.023	.028	.030	.034	.040
12 per cent	.004	.007	.011	.015	.018	.022	.026	.029	.033	.037
13 per cent	.003	.007	.010	.014	.017	.021	.024	.027	.031	.034
14 per cent	.003	.006	.010	.013	.016	.019	.022	.026	.029	.032
15 per cent	.003	.006	.009	.012	.015	.018	.021	.024	.027	.030

The prices are given in cents per pound, so that if, for instance, rock carrying 8 per cent of potash could be delivered for $9 per ton, the potash contained in it would be added to the land at a cost of 5 cents per pound. At $5 per ton the cost per pound would fall to 28 mills. The figures are of course only applicable provided the potash in the ground material can be proved available as a plant food.

It must be remembered that the only real measure of available potash is that which is made use of by the crop. It is not likely that all the potash added, even in the form of soluble potash salts, is actually used, and the amount that can be supplied by ground rock is still an unknown quantity.

POSSIBLE HARMFUL EFFECTS OF GROUND FELDSPAR.

The question is frequently asked whether there is possible danger to the land in experimenting with the use of ground feldspathic rock. It is well known that in some cases, notably with tobacco, injurious effects are produced by the continued use of the soluble potash salts, particularly the sulphate and muriate. Feldspar grains of various sizes are normally present in many soils; it does not, therefore, seem possible that any harmful effect could follow the application of ground rock. As has been pointed out in an earlier portion of this paper, feldspar consists of the alkaline elements, soda, potash, and lime, combined with alumina and silica. After decomposition, hydrated aluminum silicate, the essential base of all clays, is left behind, the alkalis and the silica being set free in a condition in which they can be absorbed by the root action of plants. It would seem, therefore, that whatever the value of the results obtained no possible harm can follow the experimental use of ground feldspar in reasonable quantities.

EXTRACTION OF POTASH FROM GROUND ROCK.

The discussion of the use of ground rock as a source of potash is not complete unless it includes the extraction of potash by chemical and electrical processes. If future experiments should demonstrate that fast-growing crops are dependent on very soluble forms of potash the question of the extraction of this element from ground feldspar becomes a matter of importance.

The extraction of potash from rock has not as yet been accomplished on a commercial basis, but it has been done in the laboratory, and the method has been published in a recent bulletin.[a] The full details of the investigation are too technical for insertion here, but if the processes described could be carried on at a cost low enough, the potash in ground rock could be rendered sufficiently soluble for all practical purposes. Briefly, the method consists in sliming the ground feldspar with water to which a small quantity of hydrofluoric acid has been added. This slime is placed inside a suitable wooden vessel and a current of electricity is passed through it. The alkali set free by the action of the acid is carried away by the electric current, while the acid appears to be used over and over again. Finally, by combining the acid and alkaline products, a material is obtained in which the potash which has been set free is soluble and available. It is hoped that further investigation will result in some method based on these principles for making the vast quantities of potash contained in feldspathic rocks completely available.

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[a] Bul. 28, U. S. Dept. of Agriculture, Office of Public Roads.

CONCLUSION.

A careful reading of the foregoing pages will show that no claim has been made that ground feldspar is an efficient substitute, under all circumstances, for potash salts. The effort has been to present all the evidence which could be collected, both for and against the use of ground feldspar as a fertilizer. The question is still open, and systematic and long-continued experimentation is the only possible method of obtaining conclusive information on the subject. The evidence so far obtained appears to indicate that under certain conditions and with certain crops feldspar can be made useful if it is ground sufficiently fine. On the other hand, it is highly probable that under other conditions the addition of ground feldspar to the land would be a useless waste of money. At the present stage of the investigation it would be extremely unwise for anyone to attempt to use ground rock, except on an experimental scale that would not entail great financial loss.

The subject must be approached conservatively, with due regard to business economy. Sensationalism and exaggeration invariably do harm. It is extremely unlikely that ground rock will ever entirely displace the use of potash salts, for its availability must inevitably depend upon many modifying conditions, such as the nature of the soil, the amount of moisture present, the character of the other fertilizers used, and the varying root action of different crops. With tobacco the results so far obtained have been encouraging, but it is possible that this plant, which is a voracious feeder, can make use of the potash in fine-ground feldspar to a greater extent than other fast-growing crops, such as potatoes and the cereals, some of which mature in practically sixty days and must therefore find their plant food in a highly available condition.

THE PHILADELPHIA
JUL 13 1907
MUSEUMS

INDEX.

	Page
Aitken, experiments with ground feldspar	15–16
Cobey, W. W., letter relative to field experiments	25
Dewey, J. S., letter relative to field experiments	24–25
Feilitzen, von, experiments with ground feldspar	20–21
Feldspar, composition	9
experiment to determine yield of potash to plants	26
ground, no harmful effects from	30
potash in, cost per pound (table)	29
production and value, 1901–1905 (table)	29
substitute for potash salts, general conclusion	31
Field experiments in Connecticut and Florida	24–25
Fineness of grinding, effect	26–28
Granite, potash content	9
Greenhouse experiments	12, 22–24
yield (table)	24
Grinding, effect of fine	26–28
Halladay, Edmund, letter relative to field experiments	25
Headden, experiments with ground feldspar	18–19
Hensel, experiments with ground feldspar	13–15
Magnus, experiments with ground feldspar	13
Maine State Experiment Station, experiments with ground feldspar	16–17
Nilson, experiments with ground feldspar	17–18
Olds & Whipple, letter relative to field experiments	25
Phosphoric acid, content in vegetable ash (table)	8
Potash as fertilizer, discussion	8
availability increased by grinding feldspar	27–28
available, defined	21–22
content in vegetable ash (table)	8
defined	21
importation of (table)	8
in ground rock, availability	11–12
method of extraction from ground rock	30–31
total, defined	21–22
Potassium carbonate, cost	22
Prianischnikow, experiments with ground feldspar	19–20
Rock-forming minerals, relative abundance in rocks (table)	9
Sestini, experiments with ground feldspar	18
Soda, content in vegetable ash (table)	8
Stone meal, use as fertilizer	13
Surface area of rock, increase by grinding	27–28
Tobacco experiments by author with ground feldspar	12, 22–24

104

32

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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. [illegible]

B. T. GALLOWAY, *Chief of Bureau.*

THE PHILADELPHIA
JUL 13 1907
MUSEUMS

THE RELATION OF THE COMPOSITION OF THE LEAF TO THE BURNING QUALITIES OF TOBACCO.

BY

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., April 13, 1907.

Sir: I have the honor to transmit herewith a manuscript entitled "The Relation of the Composition of the Leaf to the Burning Qualities of Tobacco," by Dr. Wightman W. Garner, Scientific Assistant in the Tobacco Breeding Investigations of this Bureau.

This paper contains much information of importance to growers, manufacturers, and tobacco breeders on points which have heretofore been very imperfectly understood. I would therefore recommend the publication of the manuscript as Bulletin No. 105 of the series of this Bureau.

Respectfully,
B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

CONTENTS.

Page.
Introduction 7
Effects of the various constituents of the ash on the burning qualities of tobacco 14
  Potassium 15
  Calcium 16
  Magnesium 17
  Mineral and organic acids 18
The character of the ash 21
The relation of the organic constituents to the burning qualities 22
Summary 24
Index 27

B. P. I.—285.

THE RELATION OF THE COMPOSITION OF THE LEAF TO THE BURNING QUALITIES OF TOBACCO.

INTRODUCTION.

Of the many requirements for a first-class smoking tobacco, whether for pipe or cigar, good burning qualities may be said to be most important. Not only are these essential in themselves, but the character of the combustion and the conditions under which it takes place constitute one of the principal factors which control the aroma. The widest variation is found among samples of tobacco as regards the burning qualities, and it frequently happens that an entire crop of the best quality in other respects is rendered almost valueless because it will not burn. The ultimate cause of this variation in burning qualities must be sought in differences in chemical composition. Experience has shown that the chemical composition of tobacco, as reflected in its burning qualities, is greatly influenced by the character of the soil, the climate, wet and dry seasons, and the kind of fertilizers applied to the soil. Moreover, there is good reason to believe that certain strains or types of tobacco possess the power of appropriating from the soil those constituents conducive to a good burn, while other closely related types under the same conditions are lacking in this power.

It is evident, therefore, that an accurate knowledge of the chemical characteristics of good and bad burning tobaccos is of fundamental importance in deciding upon the proper selection of soils and fertilizers in order to get the best results. It is highly probable also that such information would prove of great assistance in tobacco breeding in establishing strains possessing specially good burning qualities. Finally, it is well known that independently of the successful growing of a good tobacco crop the curing and fermentation are important factors in developing a good burn, and with a more complete knowledge of the chemical changes taking place in these processes further improvements in the methods now in use may be expected, for with better information as to the changes to be effected it will be much easier to develop the best methods for obtaining these results.

As applied to tobacco, the term "burning qualities" is a comprehensive one, including several different elements, chief of which are the fire-holding capacity, the evenness and completeness of the burn, and the character of the ash. The fire-holding capacity refers simply to the length of time the tobacco will continue to burn. Frequently samples of tobacco which possess a satisfactory fire-holding capacity show a tendency to carbonize, or "coal," in advance of the burning area and will not burn evenly. In some cases these defects appear to be due to injudicious combinations of the three component parts of the cigar, namely, the filler, the binder, and the wrapper; in other cases the cause lies in the chemical composition of the leaf. As to the quality of the ash, the important characteristics are the color and the firmness or cohesiveness. There is an essential difference between the combustion of most substances and the burning of tobacco. In the first case, the substance when ignited burns with a flame, and as soon as the flame is extinguished the combustion ceases. On the other hand, tobacco of good quality will not burn with a flame, but will continue to glow almost indefinitely.

It may be said in general that those substances which show the greatest tendency to burn with a flame have the least capacity for glowing, and vice versa, and this rule is applicable to different kinds of tobacco, for in cases of very rank growth where the leaf is thick and coarse or in any tobacco markedly deficient in mineral constituents there is a decided tendency to burn with a flame, whereas the capacity for glowing is lacking. The differences in the two kinds of combustion are well illustrated by the case of coal and its decomposition products when subjected to dry distillation. The volatile products, the larger portion of which goes to make up the illuminating gas, are inflammable, while the residual coke, consisting essentially of carbon, yields no flame when burned, but under favorable conditions will continue to glow until consumed. Now, in the burning cigar these two processes are both going on simultaneously and more or less independently of one another. The organic constituents of the leaf in the region immediately in advance of the burning area are undergoing the process of dry distillation, in which the volatile products for the most part escape and appear in the smoke. Moreover, it is this process which gives rise to the aroma. As the fire advances, the residue from the distillation, which consists of the mineral constituents of the tobacco, together with more or less carbon and stable organic condensation products, becomes incandescent, and the glow continues until practically all of the combustible matter is consumed, leaving as the final residue the ash. If certain of the mineral constituents of the tobacco which interfere with the combustion predominate, the resulting ash will be dark in color, while if others which favor the complete combustion predominate, the ash will be white, or very nearly so.

From what has been said it is perhaps not surprising that the relation of the chemical composition to the burning qualities of tobacco early attracted the attention of agricultural chemists, and this problem has led to a large number of purely chemical investigations, as well as practical field experiments. But although more than fifty years have elapsed since the publication of the first important paper on the subject, by Schlösing, no one has as yet been able to offer a satisfactory explanation of the conduct of different kinds of tobacco as regards their burning qualities. Many theories have been put forward from time to time, but they have all proved to be either fundamentally erroneous or inadequate to explain all the facts. Except a few general relations which have been pretty fully established, the results obtained by different investigators have led to widely different and oftentimes contradictory conclusions. It will not be necessary to discuss or even mention here all the work which has been published on this important subject, and only those facts which seem to be best supported will be briefly reviewed.

In comparing the composition of the tobacco plant with that of other agricultural crops, the most striking characteristic is its remarkably high content of mineral matter, commonly spoken of as the ash. In some cases the ash content reaches 25 per cent of the total weight of the dry tobacco leaf, and the average is well above 15 per cent. For this reason by far the greater portion of the work of chemists on tobacco has been devoted to the study of the composition of this ash.

Broadly speaking, there are two methods of attacking the problem of the relation of the composition to the burn, one of which may be called the analytical and the other the synthetical. Nearly all of the investigations on this subject fall under the head of the analytical method, which consists simply in making comparative analyses of samples of tobacco having good and poor burning qualities, and attempting to trace the relation between the differences in composition and the good and bad burning qualities. An examination of the composition of a typical tobacco ash will show how extremely difficult it is to draw any positive conclusions from any set of analyses which will not be subsequently contradicted by other analyses.

In the first place, there are present in tobacco three inorganic acids and three bases, all of which occur in sufficient quantities to exert an important influence on the burn and all of which are subject to wide variations in quantity in different tobaccos. With such complex variations it is almost impossible to single out those differences which really exert determinative influences on the burn. But more important still, with so many acids and bases present in the leaf, there is the possibility of very considerable differences in the distribution of the latter among the former, and in some cases these differences would certainly exert a very important influence on the burning qualities. It is quite impossible, however, to obtain any information as to the way in which the bases are distributed between the acids in different tobaccos by any available methods for the analysis of the ash. A very large number of analyses have been made of the ash of various sorts of tobacco grown in different parts of the world, but no one has been able to point out any constant relation between the varying quantities of the constituents of the ash and the differences in burning qualities.

It is to be regretted that in all these analyses no attempt has been made to distinguish between the sulphur existing in the plant as sulphate and that combined with organic compounds, although it has long been recognized that both forms are actually present, and in the case of some plants it has been found that the content of organic sulphur is much greater than that of sulphates. By the methods commonly used in the preparation of the ash for analysis, varying proportions of this organic sulphur are oxidized to sulphuric acid, while the remainder is lost; hence such analyses are valueless as a measure of the quantity of sulphate originally contained in the sample.

As opposed to the method of directly analyzing samples of tobacco with good and bad burning qualities, what may be called the "synthetical method" consists in determining the effect on the burn of adding to tobacco or some other suitable substance those compounds normally occurring in the leaf. It is difficult to get quantitative results in this way, but, on the other hand, positive results in a qualitative way can be obtained, which in the case of any one constituent added are largely independent of the effects of the other constituents. In this way conclusions are based on direct experiment and do not depend on the differentiation of several factors operating simultaneously and perhaps in opposite directions.

Schlösing[a] was the first investigator to study the problem by this method. He showed that the fire-holding capacity is not proportional to the amount of potassium nitrate, and concluded that potash in combination with organic acids is the principal factor favoring this property. If the potash is combined with sulphuric acid and chlorin and the organic acids are in combination with lime, a poor burn results; hence a tobacco with good burning qualities contains potash in excess of that equivalent to the sulphuric and hydrochloric acids. Schlösing attributed the beneficial action of the potash salts of the organic acids to their peculiar property of swelling up to many times their original volume and thus yielding a porous mass of finely divided carbon when decomposed by heat.

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[a] Landw. Vers. Stat., 3, 98.

Nessler[a] made a large number of experiments on the effects of various salts on the glowing capacity of filter paper, his method being simply to impregnate strips of the paper with solutions of the salts of definite strength. His principal conclusions are (1) that potash, especially in the form of sulphate and carbonate, acts very favorably on the fire-holding capacity, while lime and magnesia exert no marked effect except to whiten the ash; (2) that chlorids are very injurious, and (3) that potassium nitrate gives a quick but incomplete combustion, while calcium and magnesium nitrates act very favorably. Nessler admits that the organic potash salts favor the fire-holding capacity, but combats the theory of Schlösing in explanation of their favorable action. He points out that the ease with which these salts are decomposed by heat leads to carbonization, or "coaling," of the tobacco in advance of the burning area, which is a very undesirable property; and, moreover, that potassium sulphate, entirely lacking the property of swelling and yielding a carbonaceous residue when heated, also exerts a markedly beneficial influence on the fire-holding capacity. Nessler assumes that the favorable action of potash salts is due to the formation of a small amount of free potassium during the combustion, which serves as an energetic oxygen carrier; or, in other words, it is simply a catalytic action.

Mayer[b] has supplemented this work by including in his experiments many organic compounds, and concludes in general that these latter favor the burning with a flame, while they decrease the glowing capacity. The inorganic salts in general, especially those of potassium, favor the glowing capacity.

Nessler and Mayer based their conclusions on the supposition that the compounds tested would exert the same influence on tobacco as on filter paper, but this is by no means the case. The chief reason for this appears to be in the relative sensibility of filter paper and tobacco toward the salts affecting the glowing capacity. Filter paper, which is almost pure cellulose, is extremely sensitive toward metallic salts, and when moistened with a solution of any of the potash salts containing even as low as .25 per cent of potash will continue to glow indefinitely, while, on the other hand, ten times this quantity may entirely destroy this property. Tobacco contains, besides cellulose, many other organic substances which are far less combustible, and hence requires much larger quantities of these salts to produce appreciable effects on the burning qualities. For example, small quantities of potassium chlorid greatly improve the glowing capacity of filter paper, but when applied to tobacco in sufficient quantities to influence the burn the effect is very injurious. Conclusive results can not therefore be obtained by the use of filter paper alone; nevertheless they are of value as supplementing the test applied directly to the tobacco.

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[a] Landw. Vers. Stat., 19, 309.

[b] Landw. Vers. Stat., 38, 126.

Dr. E. H. Jenkins[a] determined the amounts of potassium carbonate in the ash of a number of different types of tobacco, which is a rough measure of the quantities of organic potash salts originally present in the unburned tobaccos. No constant relation was found to exist between the amount of carbonate and the fire-holding capacity, and Jenkins concludes that the burning qualities are largely influenced by the organic constituents of the tobacco.

Van Bemmelen[b] maintains that the glowing capacity is governed by the relative quantities of alkali and of hydrochloric and sulphuric acids—expressed in chemical equivalents—in the tobacco. In good-burning samples the potash is largely in excess of the acids, while in the bad-burning samples the acids are equal to or in excess of the alkali. Apparent exceptions to this rule are explained by the assumption that the potash may be partly replaced by lime and magnesia. This theory appears to be the nearest approach to the true explanation of the cause of the good and bad burning qualities of tobacco of any yet offered, but the assumption that the favorable influence of the potash on the burn may be also exerted to any considerable extent by lime and magnesia under certain conditions is contrary to the evidence bearing on this point.

Fesca[c] from his studies of Japanese tobacco, concludes that chlorin and sulphur have a very unfavorable influence on the burn, but phosphorus is indifferent.

Barths[d] agrees in general with the conclusions reached by Nessler and Mayer, and believes that the beneficial effect of potash salts are produced by the reduction of the potash compounds to potassium oxid and free potassium, which serve as energetic oxygen carriers, as was suggested by Nessler. The injurious effects of certain inorganic salts are due either to their nonreducibility or to their easy fusibility. The alkali phosphates are regarded as particularly injurious because of their easy fusibility.

Summarizing the results obtained by the investigators mentioned, it is evident that the only two facts which have not been disputed are (1) that chlorin injures the fire-holding capacity and (2) that potash favors this property.

The effects of sulphates and phosphates and the relative value of the different salts of potash in promoting the fire-holding capacity are disputed points. The same is true also of the effects of lime and magnesia on the burning qualities. The two facts which have not been contradicted are insufficient in themselves to explain the burning qualities of different samples of tobacco, for it rarely happens that tobacco contains enough chlorin to produce any injurious effects, and it frequently happens that samples very rich in potash have a poor burn, while others comparatively poor in this constituent show excellent burning qualities.

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[a] Ann. Rpt. Conn. Agr. Expt. Sta., 1884, p. 96.

[b] Landw. Vers. Stat., 37, 409.

[c] Landw. Jahrb., 1888, 329.

[d] Landw. Vers. Stat., 39, 81.

It seemed quite possible that some further light might be thrown on the subject by extracting different samples of tobacco with various solvents and noting the effect on the burning qualities. It should be stated here that all samples of tobacco used in the experiments described in this paper had been thoroughly fermented, and the results are not intended to be applied to unfermented tobacco. Extraction of various samples with petroleum ether and with ordinary ethyl or sulphuric ether did not appreciably affect the burning qualities. When strong alcohol was used as the solvent the same result was obtained, except in a single case, where the fire-holding capacity was considerably improved by the extraction.

More striking results are obtained when tobacco is extracted with water. The following simple experiment is very interesting and instructive: A leaf of tobacco having a good glowing capacity is divided along the midrib into two parts, one of which is extracted for forty-eight hours with a comparatively large volume of distilled water. After being dried the extracted portion of the leaf will be found to have entirely lost its glowing capacity. Now, if the extract be evaporated down to a very small volume and a bit of the extracted leaf saturated therewith and dried, it will once more show a good fire-holding capacity. Whether this is less or greater than the original leaf possessed will depend, of course, on the concentration of the extract. This extract will further impart a good burn to filter paper and to other samples of tobacco showing poor burning qualities. This simple experiment seems to prove conclusively that the active principle or principles in imparting to the tobacco leaf its capacity for holding fire can be extracted with water.

The problem, then, is to determine the composition of the extract and to discover which of its constituents contribute to the burning qualities of the tobacco. One hundred grams of tobacco having a good burn were extracted with 1 liter of distilled water; the extract was poured off and the tobacco again extracted with the same quantity of water for twenty-four hours longer. The extracts thus obtained were combined, filtered, and evaporated to about 150 c. c. During the evaporation a considerable quantity of calcium citrate separated out, which was removed by filtration. The filtrate was made up to 200 c. c. and aliquot portions were taken for analyses. The principal constituents of the extract are the chlorid, sulphate, nitrate, citrate, and malate of potassium, together with ammonium and nicotine salts and small quantities of lime and magnesia. For comparison, the ash of the extracted tobacco was also examined and it was found that practically all of the phosphoric acid, about one-half of the magnesia, all of the oxalic acid, and the greater portion of the lime remain in the leaf, while the extract contains nearly all the chlorin, all the potash, malic, citric, and nitric acids, and most of the sulphuric acid. About one-half of the total ash is extracted from the leaf by this process, and this seems to contain all the constituents which impart to the tobacco the capacity for holding fire.

An extract of a tobacco having poor burning qualities was prepared in the same way, and it also showed the power to impart the capacity for holding fire, but as nearly as could be measured this power was only about one-fifth of that shown by the extract from the tobacco having good burning qualities. It differed from the latter as regards composition in that it contained about five times as much sulphuric acid, twice as much magnesia, and considerably less nitric acid. The total quantity of potash was about the same in the two extracts, so that the extract from the tobacco with poor burning qualities contained much less potash in combination with the organic acids. The difference in composition of these extracts, then, obtained from tobaccos having good and bad burning qualities, indicates that the principal factor favoring the burn is the potash in excess of the amount required for combining with the mineral acids.

EFFECTS OF THE VARIOUS CONSTITUENTS OF THE ASH ON THE BURNING QUALITIES OF TOBACCO.

The experiments previously described show conclusively that those compounds which are most important in promoting the burn of tobacco can be removed by extraction with water; but the water extract is a complex mixture of salts, and it is therefore desirable to determine the relative effects of each of these constituents. In order to do this, solutions of certain definite strength were prepared of all of the salts which are found in the extract, and the effects of all these on the burning qualities of various samples of tobacco when applied singly or in combination were noted. In testing the effects of any one base combined with the different acids the solutions were all made of such strength that the quantity of the basic element was always the same, regardless of the molecular weights of the salts used in the experiments. The salt solutions were applied to small strips of the leaf, either by placing them in a watch glass and pouring over them a quantity of the solution to be tested just sufficient to thoroughly saturate them, thus avoiding any leaching out of the soluble constituents of the leaf, or by spraying the strips and allowing them to stand in a moist atmosphere until the solution had diffused through the leaf. In every case a strip of the leaf adjoining the portion treated with the solution was reserved for comparison. The tests on different samples of tobacco did not always agree, as was to be expected, since the quantities of the various salts already present in the leaf are subject to wide variation, and these differences in some cases may overshadow the effects of the salt added. For the same reason the concentration of the solution added must be taken into account. To overcome these factors it is necessary to apply each test to a number of different samples of tobacco. The tests on tobacco were always further supplemented with similar experiments on strips of filter paper.

There are three base-forming elements which occur in tobacco in sufficient quantities to require consideration—potassium, calcium, and magnesium—while the important mineral acids are sulphuric, phosphoric, hydrochloric, and nitric, and the chief organic acids are citric, malic, and oxalic. Little is known of the actual distribution of the three bases among the acids and so it is necessary to test all of the possible combinations. It is probable, however, that the sulphuric, nitric, and hydrochloric acids are for the most part combined with potash so far as the quantity of this base present will suffice to neutralize these acids and that any excess of potash would be in combination with the organic acids. All of the oxalic acid appears to be combined with lime. If the acids and bases were allowed to interact in the presence of water, the distribution of the latter among the former would be controlled simply by the relative solubilities of the resulting salts and the strengths of the acids and bases; but during the life processes of the plant, which do not cease until some time after the tobacco has been placed in the curing shed. other forces come into play, and it hardly seems probable that there is sufficient water left in the leaf after the life activities have ceased to permit of a readjustment between the acids and bases according to purely chemical forces.

POTASSIUM.

All the salts of potassium are soluble, so that there is no difficulty in testing the salts at any desired concentration. Those most used for applying the tests to tobacco contained 1 per cent and 2 per cent, respectively, of potassium, while for tests with filter paper much weaker solutions gave the best results. In the case of the chlorid it was found that the addition of comparatively large quantities practically destroyed the burning qualities of tobacco, while moderate amounts caused very incomplete combustion, leaving a heavy black residue. While chlorin is undoubtedly injurious, these experiments all indicated that it requires larger quantities to seriously affect the burning qualities than is commonly supposed. The sulphate, when added in any considerable quantity, invariably injured the burning qualities very markedly, acting in this respect very much like the chlorid but to a lesser degree. The conclusion reached by Nessler that potassium sulphate is highly beneficial, which was based on experiments with filter paper, is thus shown to be erroneous. Potassium nitrate in large quantities causes tobacco to burn explosively and the combustion is incomplete; in smaller quantities it exerts a distinctively beneficial action, but not more so than some other potash salts. The quantity of potash combined with nitric acid in tobacco is generally comparatively small, and other forms of potash are more important in promoting the fire-holding capacity. As regards the phosphates, only the dipotassium salt need be considered, and this appears to be practically neutral in its action, neither promoting nor hindering the fire-holding capacity. Moreover, as compared with the other important acids the quantity of phosphoric acid is nearly always small. The oxalate, citrate, malate, and acetate of potash all showed very beneficial effects in every case, though much larger quantities were required for some samples of tobacco than for others. Excessive amounts of these salts, on the other hand, injured the burning qualities, especially as regards the character of the ash. Also when applied to filter paper in small quantities the latter acquires a good fire-holding capacity, whereas large amounts again destroy this property. The acetate is considerably less efficient in improving the fire-holding capacity than the other three organic salts, probably on account of its greater stability.

CALCIUM.

Considerable difficulty is met with in getting accurate tests with the calcium salts because nearly all of them are difficultly soluble, and hence solutions can not be obtained of sufficient strength to give decided results. Only the chlorid, nitrate, and acetate are easily soluble, and of these the nitrate shows an anomalous conduct, and so the results obtained with this salt are not specially significant. In the case of the insoluble salts, emulsions were applied to the tobacco, but of course results obtained in this way are not as reliable as those secured by use of solutions. The chlorid of calcium is very injurious to the fire-holding capacity and decidedly more so than the potassium salt, so that even small quantities destroy this property. Calcium sulphate in moderate quantities injures the burn markedly and to a greater extent than the corresponding potassium salt. The effect of the nitrate of calcium on the burn is somewhat surprising. If a sample of tobacco with good burning qualities is saturated with a 10 per cent solution of the nitrate and dried, it burns with extreme rapidity, almost explosively, and gives a remarkably white ash, while with samples of tobacco with poor burning qualities scarcely any beneficial effects are produced. More dilute solutions, such as were used in the case of the other salts, do not produce any appreciable effects. Moreover, it requires a concentrated solution to impart to filter paper a good fire-holding capacity. It seems likely that the effects of the concentrated solution on the tobacco with the good burning qualities are due largely to reaction of the calcium nitrate with potash salts in the leaf. So far as could be determined no marked effects are produced by adding calcium phosphate to tobacco. The acetate of calcium is of special interest because it is readily soluble and thus furnishes an opportunity of comparing the relative effects of potassium, calcium, and magnesium on the burning qualities. Of a large number of samples of tobacco tested a few were improved by the acetate, but the greater number were scarcely affected as regards the capacity for holding fire. In every case, however, the color of the ash was very materially improved. None of the remaining salts of calcium to be considered are easily soluble, but so far as could be determined they neither injure nor improve the fire-holding capacity to any considerable extent, but all give a decidedly whiter ash.

MAGNESIUM.

All the salts of magnesium are readily soluble except the phosphates, and so it is much easier to get satisfactory results with them than is the case with the calcium compounds. The chlorid and sulphate are both very decidedly injurious to the burn, and the addition of even small quantities will destroy the glowing capacity of tobacco having the very best burning qualities. The sulphate is much more injurious than the corresponding calcium salt. The nitrate acts very much like the calcium compound, but its action when applied in concentrated solution is less marked. When applied to filter paper it shows the peculiar property of charring the paper in wave-like forms much in advance of the burning portion. The phosphate of magnesium appears to be more injurious to the burn than the corresponding calcium compound. The acetate was found to injure the burning qualities in every case, but to a lesser extent than the inorganic salts. The citrate, malate, and oxalate in a few cases did not interfere with the burn, but in the greater number harmful effects were observed. All of the salts of magnesium, like those of calcium, tend to produce a white ash.

MINERAL AND ORGANIC ACIDS.

In describing the results of the tests with the various salts these have been grouped under the heads of the three bases, potassium, calcium, and magnesium, but it is also instructive to consider them arranged according to the acids with which these bases are combined.

Chlorids.—All of the chlorids injure the burn, but that of potassium much less than the calcium and magnesium salts.

Sulphates.—All of the sulphates injure the fire-holding capacity, but to very different degrees. The potash salt is decidedly less harmful than that of calcium, while the magnesium compound is remarkably injurious, being comparable with the chlorids in this respect.

Nitrates.—The potash salt is very favorable to the burn, but the calcium and magnesium compounds produce little effect except when present in very large quantities.

Phosphates.—Dipotassium phosphate is practically neutral in its effect, while the calcium and magnesium salts are somewhat harmful.

Salts of organic acids.—The potassium salts are very favorable to the burn, the calcium salts are slightly beneficial, and the magnesium salts are somewhat injurious.

It would seem from these results that the effect on the fire-holding capacity of any element entering into the composition of the ash depends more on the nature of its combination than on the quantity which is present. In the case of sulphuric acid, for example, a considerable quantity combined with potash would not seriously injure the glowing capacity, while even a small amount of it in combination with magnesium would entirely destroy this property. Again, the organic acids when combined with potash are very beneficial, but in combination with magnesia their favorable influence entirely disappears.

It is evident that the one element on which the fire-holding capacity is entirely dependent is potassium. But it is equally essential that part of the potash be in combination with organic acids, for it is to this form chiefly that its beneficial action is due. The nitrate of potash when present in considerable amounts undoubtedly contributes also to this property. Schlösing, as has been said, attributed the beneficial effects of the organic potassium salts to the peculiar property which they possess of swelling up to many times the original volume when decomposed by heat, thus leaving a very porous, finely divided residue of carbon, which continues to glow until combustion is complete. This explanation, however, is inadequate, for there are other salts which promote the glowing capacity but do not yield the carbonaceous residue when heated.

It will be observed that all the potash salts which favor the property of glowing, including the nitrate, yield in the combustion the carbonate. It was found, in fact, that the carbonate itself is just as efficient in imparting the property of glowing to tobacco as the organic salts, and the same is true of the bicarbonate. This fact points strongly to the conclusion that the favorable action of the potash salts is dependent on the ease with which they yield the carbonate. It seems possible that the carbonate or bicarbonate by alternately giving off and taking up carbon dioxid may serve as a means of removing this gas at the most favorable moment, the effect being somewhat the same as when nitrates render organic substances combustible by supplying oxygen in a highly concentrated state. It may be, however, that the potassium oxid formed from the carbonate is further reduced to the metallic state by the highly heated carbon, thus serving as an energetic oxygen carrier, as was suggested by Nessler. Whatever may be the peculiar properties of these potash salts which give them the power of imparting the property of glowing to tobacco, it is certain that these properties are not shared by the salts of calcium and magnesium except to a very limited degree.

While the inorganic salts of calcium are injurious to the fire-holding capacity, the compounds of this base considered collectively may be said to be inert with reference to this quality. The compounds of magnesium are all injurious, but the harmful effects are greatly reduced when the magnesium occurs in combination with the organic acids.

The question has often been raised whether lime and magnesia may not, in part at least, replace potash without injuring the burning qualities. Many ash analyses which have been made seem to indicate that this is the case, while others point to the opposite view. This assumption is made by Van Bemmelen[a] to explain the fact that in some samples of tobacco which show a good fire-holding capacity the total quantity of potash is only very slightly in excess of that necessary to neutralize the sulphuric and hydrochloric acids. But Van Bemmelen's calculations are all based on the ash analyses, and it has been pointed out that the estimation of the sulphuric acid in the ash gives no indication of the quantity of sulphur actually present in the tobacco in the form of sulphates and therefore that the amount of potash in organic form may be considerably greater than calculations based on these data would indicate.

In so far as lime alone is concerned the conclusion to be drawn from our experiments is that this can only replace part of the potash when the latter is present in combination with organic acids in quantities larger than are necessary to produce a good burn; for while organic salts of lime do not appear to injure the fire-holding capacity, they do not specially favor it. The amount of potash in organic form necessary to impart the property of glowing to tobacco no doubt is influenced to some extent by variations in the other organic constituents of the leaf, but our experiments have shown that excessive quantities of these salts tend to injure the burn by causing a too rapid combustion. It may happen, therefore, that a sample of tobacco contains more organic potash than is necessary to produce the best burn, and in such cases a portion of it could be replaced to advantage by lime. Since magnesia compounds as a whole tend to injure the burn it seems certain that the replacement of potash to any considerable extent by this element would seriously injure the burning properties.

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[a] Landw. Vers. Stat., 37, 409.

For purposes of experimentation looking to the production of tobaccos possessing superior burning qualities, either by means of fertilizers and improved methods of curing and fermentation or by breeding and selection, it is very desirable to have at hand some method of testing the results by chemical examination. This is especially true because of the complexity of conditions which influence the qualities of tobacco. For example, if the attempt is made to improve the burning qualities by the use of certain potash salts, with a view to increasing the amount of potash in organic form in the tobacco, the result of the experiment may be entirely obscured by extraneous factors, such as improper curing and fermentation, if the fire-holding capacity alone were determined. Of course, in this particular case chemical analysis would reveal whether the object sought had really been attained, but there are other questions of chemical composition pertaining to this problem which can only be measured with difficulty by the methods at present available. This is especially true of the manner in which the bases are distributed among the acids in tobacco and whether this distribution is essentially different in different samples.

All of the important organic acids, and also nitric acid, when combined with potash seem to be about equally efficient in promoting the fire-holding capacity. Oxalic acid, however, is probably always combined with lime and so it is of little value in this connection. Since a portion at least of the potash combined with organic acids, as well as that present in the form of nitrate, will appear in the ash of the tobacco as carbonate, the determination of this latter quantity gives a rough measure of the amount of these salts originally present and is therefore by far the most important single criterion for judging the burning qualities in a chemical way.

We have tested a number of samples of tobacco grown in Connecticut in this way, in each case using one half of the leaf for testing the alkalinity of the ash and the second half for finding the fire-holding capacity. To obtain some indication as to whether lime and magnesia can partly replace the organic potash, the alkalinity of the ash due to these bases was also determined, but the evidence on this point was all of a negative character, for the alkalinity due to lime and magnesia collectively did not show any apparent relation to the glowing capacity. In the case of the alkalinity due to potash—that is, the quantity of the potassium carbonate—however, there is unmistakable evidence of a close relation between these values and the capacity for holding fire, and if the method were really a true measure of the organic potash it is believed that there would be very few, if any, exceptions to this rule.

The samples used for this test were selected with special reference to the tobacco-breeding experiments which are being carried on by the Bureau of Plant Industry, and were taken from crops produced from the seed of individual selections of four different types of tobacco originally found growing in the same field. Both the light and the dark wrappers were examined in each case, and in every instance the former as compared with the latter showed a much greater fire-holding capacity and a much higher percentage of potassium carbonate in the ash. Also as regards the same grade of leaf of the different strains of each type, as well as of the different types taken collectively, the potash alkalinity was found to be directly proportional in nearly every case to the capacity for holding fire. This was especially true of the different strains of any one type. These tobaccos were all grown under as uniform conditions as could be obtained with reference to soil and fertilizers, and the results make it very probable that certain types or strains of tobacco possess the power of appropriating potash in forms favorable to the burning qualities to a greater degree than others growing under the same conditions, though further data are required to fully prove this point. The question is certainly a very important one from the standpoint of practical tobacco breeding and is worthy of very careful study.

THE CHARACTER OF THE ASH.

A tobacco with satisfactory burning qualities besides having the necessary capacity for holding fire must also yield a good ash. Although the organic potassium salts greatly favor the fire-holding capacity, they tend to produce a mottled, dark-colored ash. This is no doubt due to the easy fusibility of the alkali carbonate, which in melting incloses very small particles of unburned carbon and thus prevents complete combustion. Moreover, these salts when present in considerable quantity show a tendency to cause the tobacco to "coal" or carbonize in advance of the glowing portion, because they decompose so readily when heated.

The fact that the calcium and magnesium salts produce a white ash has already been mentioned, and at least one of these is essential to this property. On the other hand, tobacco containing excessive amounts of lime gives an ash which, although it is very light in color, lacks cohesion, or, in the language of the trade, it "flakes." This is a very objectionable property and must always be taken into account in judging the burning qualities of tobacco. The potash salts, more especially the organic compounds, yield an ash which is firm and compact but dark in color. From these facts, then, it is clear that potash and lime combined in the proper proportion are essential to a firm, light-colored ash. There is no apparent reason to suppose that magnesia is of any special significance in this connection further than the fact that it acts like lime.

THE RELATION OF THE ORGANIC CONSTITUENTS TO THE BURNING QUALITIES.

The organic compounds constitute the material which is consumed in the combustion of the tobacco, and in some way the mineral constituents, more particularly the potash salts, impart to this material the property of burning without flame. If the mineral constituents are extracted from a leaf of tobacco, it will then only burn with a flame, the glowing capacity having been entirely lost. However, some of the organic compounds show a greater tendency to burn with a flame than do others, and hence act less favorably on the glowing capacity, for, as has been stated, these two qualities usually stand in inverse ratio to one another. The principal compounds or classes of compounds which need to be considered in this connection are cellulose, the organic acids, pectin, the so-called tobacco tars, plant wax, the sugars, nicotine, and other organic nitrogenous compounds. For the purpose of studying the composition of the leaf with reference to its burning qualities we may consider cellulose, which constitutes from 10 to 15 per cent of the total weight, as the fundamental or basic material, which receives its capacity for glowing from certain mineral salts. Pure cellulose in the form of filter paper is exceedingly sensitive to the catalytic action of these mineral salts, very small quantities of them being sufficient to cause the paper to burn without flame indefinitely, but when the other organic constituents of tobacco are present this sensibility is greatly affected and much larger quantities of the catalytic agent are necessary to produce a good fire-holding capacity. Cellulose, then, must be considered as a very favorable factor in promoting this property of holding fire.

There are a large number of organic acids normally occurring in tobacco, but of some of these practically nothing is known. Attention has been called to the fact that citric, malic, oxalic, and acetic acids in combination with potash exert a very favorable influence on the burning qualities. It was found by direct experiment that these acids in the free state injure these qualities, but as they probably never occur free in fermented tobacco this fact is of little consequence. Citric and malic acids are undoubtedly of fundamental importance in producing good burning qualities, but since oxalic acid occurs in combination with lime and not with potash in tobacco it is of little value in this respect. Pectin and the pectoses are present in considerable quantities in cured tobacco leaves, but, according to Schlösing, these are all converted into pectic acid during the process of fermentation. A sample of pectic acid prepared from fermented tobacco was found to produce no injury to the fire-holding capacity; in fact, when combined with potash it acted favorably on this property.

According to Kissling, the tobacco tars, consisting of a mixture of a number of chemical individuals, exert an important influence on the quality of the product. Some of these are of an acid character, while others are indifferent substances. When tobacco is extracted with large volumes of water, as previously described, considerable quantities of these tarry acids combined with nicotine and other bases pass into solution, and on evaporation of the extract the salts are decomposed, the nicotine volatilizing and the tarry acids being precipitated. These acids in the free state were found to be decidedly injurious to the burning qualities, but they occur in tobacco in comparatively small quantities.

A number of samples of tobacco of very poor burning quality were extracted with alcohol to determine if this solvent would remove any constituents deleterious to the burn, but with the exception of a single case this treatment did not improve the tobacco in this respect. The constituents removed by extraction with alcohol are nicotine combined with acids, tannic acid, glucosides, sugars, and the tars and tarry acids; hence it appears that none of these compounds are of special importance with reference to the burn. Direct experiments showed that glucose does not materially influence the burning qualities. Nicotine is the characteristic alkaloid of tobacco and is of great importance with reference to its physiological action, but its salts were found to have no effect on the burn. In addition to nicotine the important nitrogenous constituents are the amido compounds and the albuminoids. It is generally believed that the amido compounds exert a favorable and the albuminoids an unfavorable influence on the desirable qualities of tobacco, including the burn, although there is little experimental proof of this theory. The quantity of plant wax occurring in tobacco is too small to affect the burning qualities.

SUMMARY.

The principal facts brought out by the experiments which have been described on the relation of the chemical composition to the burning qualities of tobacco may be briefly summarized in the following general statements:

(1) The fire-holding capacity is dependent primarily on the content of potash combined with organic acids.

(2) Lime in general does not greatly affect the fire-holding capacity, but is an essential factor in the production of a good ash.

(3) Large amounts of magnesia tend to injure the capacity for holding fire.

(4) Chlorin injures the burning qualities, but it seldom happens that tobacco contains enough of this element to do any serious harm.

(5) Sulphates in general injure the burning qualities, but the effects are not so marked when all the sulphuric acid is combined with potash.

(6) So far as is known none of the organic constituents of tobacco, with the possible exception of the so-called tarry acids and the albuminoids, exert a very important influence on the burning qualities.

From these conclusions it appears that the principal objects to be attained in efforts to improve the burning qualities of tobacco by breeding and by improved methods of production, especially in the use of the proper fertilizers, are (1) a relatively high content of potash combined with citric and malic acids, with a minimum amount of inorganic salts, especially chlorids and sulphates; (2) a moderate content of lime; (3) a comparatively small percentage of magnesia, and (4) a low content of organic nitrogenous compounds, more especially the albuminoids or proteids. Of these problems the first mentioned is altogether the most important from a practical standpoint and also the most difficult to solve. It has long been known that the muriate can not be used as a source of potash in the production of tobacco which is intended for smoking purposes, because of the injurious effects of the chlorin. The other available sources of potash at the present time are the sulphate, the carbonate, and the silicate.

Schlösing,[a] in his experiments with the use of the sulphate as a fertilizer for tobacco, found that the potash is assimilated, while the content of sulphuric acid is not increased. Jenkins,[b] on the other hand, in experiments conducted at the Connecticut Agricultural Experiment Station and extending over a period of several years, has shown that the composition of tobacco ash is profoundly modified by the use of different forms of potash and that applications of the sulphate greatly increase the quantity of sulphuric acid in the ash. The carbonate would seem to be an ideal form in which to supply the potash for combining with the organic acids in the plant, and its use has generally been found to improve the burning qualities. But, aside from the high cost of this material, there are other serious objections to its use, for it has a very strong alkaline reaction, and it seems probable that when used in large quantities it will eventually injure seriously the productiveness of the soil. The silicate is free from these objectionable properties, and if the potash can be made available there is every reason to believe that this will prove to be a very valuable source of potash for tobacco.

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[a] Landw. Vers. Stat., 3, 98.

[b] Ann. Rpt. Conn. Agr. Expt. Sta., 1896.

The sum of the lime and the magnesia in tobacco does not, as a rule, vary widely; or, in other words, the greater the amount of lime the less will be the amount of magnesia, and vice versa. The application of fertilizers containing magnesia increases the percentage of this element in the tobacco, but when used in the form of the carbonate the injury to the burning qualities would be reduced to a minimum. It is believed, however, that the use of fertilizer salts containing magnesia in the form of sulphate is inadvisable.

The percentage of organic nitrogenous compounds, including nicotine, is generally proportional to the luxuriance and vigor of growth; hence tobacco of very rank growth contains excessive quantities of these constituents. Again, these substances are most abundant when the plant is, as a whole, growing most rapidly, and also in the most rapidly growing parts of the plant. Conditions favorable to rank growth are brought about by the use of excessive quantities of nitrogenous fertilizers, especially when the nitrogen is in readily available forms. The chief danger from this source, however, lies in the application of quickly available forms of nitrogen during the later stages of growth, thus preventing or delaying the normal ripening of the leaf. Since the percentage of albuminoids decreases rapidly throughout the ripening process after the leaf has reached its full growth, this is an important reason why tobacco should not be harvested until the leaf is well ripened.

THE PHILADELPHIA
JUL 1? 1907
MUSEUMS

INDEX.

Page.
Acids, organic, relation to burning qualities 22
    salts, effects on burning qualities 18
Alkalinity of ash, relation to burning qualities 20
Ash constituents, effects on burning qualities 14
    relation of alkalinity to burning qualities 20
Breeding, improvement of burning qualities by selection 21
Burning qualities, meaning of term 8
Calcium salts, effects on burning qualities 16
Cellulose, relation to burning qualities 22
Chlorids, effects on burning qualities 18
Combustion process in tobacco and burning with a flame, differences 8
Composition of leaf, relation to burning qualities, previous investigations 10
Extraction of tobacco with various solvents, effects on burning qualities 13, 23
Extracts of tobacco, water, composition 14
Fertilizers containing magnesia, use 25
Flame, burning with, and combustion process in tobacco, differences 8
Improvement of burning qualities, objects to be attained 24
Leaf, composition, relation to burning qualities, previous investigations 10
Lime, effect on character of ash 22
Magnesium salts, effects on burning qualities 17
Nitrates, effects on burning qualities 18
Nitrogenous constituents, conditions favoring excessive production 25
    relation to burning qualities 23
Organic acids, relation to burning qualities 22
    salts, effects on burning qualities 18
    constituents, relation to burning qualities 22
Phosphates, effects on burning qualities 18
Potash, effect on character of ash 21
    fertilizers, effects of different forms on composition of ash 24
    for tobacco, available sources 24
    partial replacement by lime and magnesia 19
Potassium salts, effect on burning qualities 15, 19
Sulphates, effects on burning qualities 18
Sulphur in tobacco, two forms 10
Tars, tobacco, relation to burning qualities 23
Water extracts of tobacco, composition 14

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THE PHILADELPHIA MUSEUMS
FEB 19 1908

U. S. DEPARTMENT OF AGRICULTURE.
BUREAU OF PLANT INDUSTRY—BULLETIN NO. 106.
B. T. GALLOWAY, *Chief of Bureau.*

SEEDS AND PLANTS IMPORTED

DURING THE PERIOD FROM DECEMBER, 1905, TO JULY, 1906.

INVENTORY No. 12; Nos. 16797 TO 19057.

ISSUED DECEMBER 20, 1907.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1907.

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SEED AND PLANT INTRODUCTION.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., April 13, 1907.

Sir: I have the honor to transmit herewith, and to recommend for publication as Bulletin No. 106 of the series of this Bureau, the accompanying manuscript, entitled "Seeds and Plants Imported During the Period from December, 1905, to July, 1906."

This manuscript has been submitted by the Agricultural Explorer in Charge of Seed and Plant Introduction with a view to publication.

Respectfully,

B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

THE PHILADELPHIA
FEB 19 1908
MUSEUMS

B. P. I.—238.

SEEDS AND PLANTS IMPORTED DURING THE PERIOD FROM DECEMBER, 1905, TO JULY, 1906.

INTRODUCTORY STATEMENT.

This twelfth inventory of seeds and plants imported, prepared under the immediate supervision of Mr. Walter Fischer, represents the accessions of this Office between the dates of December 15, 1905, and July 27, 1906, a period of about seven months. It contains 2,260 items, which is as large a number as was represented by the collections of a whole year when this Office was organized in 1898, notwithstanding the fact that the present lists are the result of a more rigid selection than at the outset.

To the outsider it may seem strange that larger numbers of plants and seeds are not accumulated in so long a period. To these it may be said that it is not the object of the work of plant introduction to collect as many species and varieties of plants which may have some economic use in this country as is possible, but rather to carefully collect only such forms as can be put to a really practical use by American cultivators. This Office is informed of hosts of useful plants now growing in different parts of the world which are not yet on the program of practical plant introduction. At a small expense thousands of these useful plants could be gathered and placed in collections, but the cost of maintaining any one of them would in a few years far exceed the cost of procuring it anew for the definite experiments of the experts of the country who may want it for breeding purposes, as a stock on which to graft, or as a possible new crop for hitherto unused lands.

The principle, then, of systematic plant introduction, as it is carried on by this Office, is to get the seeds and plants that are wanted for the solution of definite problems in the establishment of new plant industries; import them in sufficient quantities for large and conclusive experiments, and place them as soon as possible in the hands of experts who will carry out at once such experiments.

Among the collections of new introductions included in this inventory there are some that are worthy of special mention here. Principal among these are the collections of our agricultural explorer

Mr. Frank N. Meyer, who was sent out to northern China in the summer of 1905 and who has been exploring the remarkable plant regions of the mountains north and west of Peking. His finds, coming as they do from a region with as severe a winter as that of the Middle States, will surely be, we believe, valuable to plant growers over a wide range of territory. In fact, the preliminary trials that have been made with these North Chinese plants in this country show that as a rule they have a degree of hardiness and resistance to disease which their close relatives from Japan, now so abundantly represented in our gardens and fields, do not possess. Mr. Meyer's explorations have been made into different places, difficult and sometimes dangerous of access, and at no little sacrifice of personal comfort and risk to his health and safety. The collections cover a wide range of things for which there is a demand already created by breeding, grafting, and other experiments which have been carried on in this country during the past decade. The material sent in is now in process of propagation, and as soon as ready will be sent out to experimenters.

Other collections worthy of notice are a number of new sorghums from tropical Africa, the home of the sorghum plant; a collection of the interesting new wet-land root crop, the yautia, from Porto Rico; some interesting new forms of potato from Bolivia; leguminous plants for breeding as fodder producers, collected from various parts of the world; forage and fodder grasses in large numbers from many different foreign countries; the Queensland nut Macadamia, which is a possibility for California; the South China soap tree, which has recently come into some prominence in Algeria as a source of saponin, a commercial product used in the manufacture of soaps; a collection of hardy grass and forage plant seed from the Austrian Alpine garden at an altitude of 5,700 feet; three new pistache species for breeding and for stocks on which to graft the ordinary edible variety of this nut, from the borders of Afghanistan, North China, and northern Persia; a collection of West Indian yams, promising possibilities as a change from the monotony of the Irish potato; a number of new Mexican apricots for the fruit-growing areas of Texas and the Gulf States; and a very important collection of the edible-fruited and fodder cacti, made by the cactus expert of the Department, Dr. David Griffiths, who has made experimental plantings of these most interesting plants in the dry regions of the Southwest.

David Fairchild,
Agricultural Explorer in Charge

Office of Seed and Plant Introduction,
Washington, D. C., April 12, 1907.

INVENTORY.

16797 to 16806.

From Budapest. Presented by Dr. A. de Degen, director of the Royal Hungarian Seed Control. Received December 15, 1905.

Seeds of native Hungarian grasses, as follows:

16797.	BROMUS VERNALIS.
16798.	BROMUS PANNONICUS.
16799.	AVENA DECORA.
16800.	ALOPECURUS BRACHYSTACHYUS.
16801.	FESTUCA CARPATHICA.
16802.	FESTUCA ELATIOR.
16803.	PIPTATHERUM VIRESCENS.
16804.	GLYCERIA NEMORALIS.
16805.	POA HYBRIDA.
16806.	POA CHAIXII.

16807. ORYZA SATIVA. **Upland rice.**

From Pretoria, Transvaal, South Africa. Presented by Prof. J. Burtt Davy, agrostologist and botanist of the Department of Agriculture. Received December 18, 1905.

"Seed grown in a subtropical valley near Sucre, Bolivia, at an altitude of about 10,000 feet. It is treated as a dry-land crop, like maize." (*Davy.*)

16808. RUBUS sp. **Red raspberry.**

From Baguio, Benguet Province, P. I. Presented by Mr. W. S. Lyon, Bureau of Agriculture, Manila, P. I. Received December 11, 1905.

16809. PANICUM MOLLE. **Para grass.**

From Georgetown, British Guiana. Presented by Mr. A. W. Bartlett, government botanist. Received December 19, 1905.

"A valuable grass for pasture and forage in the Tropics. This grass grows luxuriantly in damp meadows and is readily eaten by horses, cattle, and sheep." (*Bartlett.*)

16810. XANTHOSOMA sp. **Yautia.**

From Ancon, Panama. Presented by Mr. George F. Halsey. Received December 19, 1906.

"Tubers of a plant locally called *Oto*, *Coco*, or *Comorata*. It is very hardy and grows best in a well loosened, moist soil, and the tubers can be cut into many sections and planted like potatoes." (*Halsey.*)

16811. VICIA AMERICANA. **American vetch.**

From Fergus Falls, Minn. Presented by Mr. C. J. Wright. Received December 20, 1905.

This is is a native vetch which grows wild in woods and copses in the northeastern United States. It is much relished by stock and might perhaps be cultivated to some extent with profit.

16812. VIGNA UNGUICULATA. **Cowpea.**

From West Branch, Mich. Received through Ogeman Grain and Seed Company, December 20, 1905.

16813 to 16820.

From Office of Drug and Medicinal Plant Investigations. Received through Dr. R. H. True, December 9, 1905.

Seeds of medicinal plants, as follows:

16813. DIGITALIS PURPUREA. **Purple foxglove.**

"The common purple foxglove cultivated in some parts of Europe for its leaves, which are a valuable remedy. The leaves are officinal when picked during the time of flowering. This is one of the most important remedies in certain kinds of heart trouble." (*True.*)

16814. LOBELIA INFLATA. **Indian tobacco.**

"A native weed in open situations of the eastern United States. Both seed and herb collected for drug purposes. Has an emetic, expectorant, and antispasmodic action. Is a strong poison, capable of producing fatal results." (*True.*)

16815. ATROPA BELLADONNA. **Belladonna.**

"Cultivated in several parts of Europe for the leaves and roots, which form one of the chief sources of atropine. The attractive looking fruits also contain atropine and are not rarely eaten by children with fatal results. Is sparingly cultivated in the United States for drug purposes." (*True.*)

16816. NEPETA CATARIA. **Catnip.**

"A common weed of the United States, collected in its wild condition for drug purposes. It is valued as a domestic remedy for its carminative, stimulant, and tonic properties, due to the volatile oil present in the herb." (*True.*)

16817. CAPSICUM FASTIGIATUM. **Japanese chillies.**

"Cultivated in the Orient for the small bright red fruits, having a very pungent taste. Used in medicine for the digestant and rubifacient properties, and also for making the ground cayenne peppers of the spice market." (*True.*)

16818. CAPSICUM FASTIGIATUM. **Small capsicum.**

16819. PAPAVER SOMNIFERUM. **Asiatic poppy.**

"A blue-seeded variety cultivated in the Orient as a source of opium, and in parts of Europe for the seeds, from which an agreeable bland oil is expressed. Seeds from plants grown at Burlington, Vt." (*True.*)

16820. PAPAVER SOMNIFERUM. **Asiatic poppy.**

A white-seeded variety to which the same remarks apply as to the preceding.

16821 to 16852.

From the Office of Farm Management Investigations. Received December 21, 1905.

A collection of grass seeds, as follows:

16821. BROMUS RUBENS.

From Caliente, Kern County, Cal., July 2, 1904. (Agrost. 2132.)

16822. BROMUS sp.

From Arizona, 1904. (Agrost. 2134.)

16823. BROMUS INERMIS. **Smooth brome-grass.**

From Argentina. Peluff's collection, 1904. (Agrost. 2440.)

16824. BROMUS INERMIS. **Smooth brome-grass.**

From Arezzo, Italy, 1904. (Agrost. 2351.)

16821 to 16852—Continued.

16825. BROMUS INERMIS. **Smooth brome-grass.**
From Austria-Hungary. Peluff's collection, 1904. (Agrost. 2449.)

16826. BROMUS PRATENSIS. **Meadow brome-grass.**
From Padua, Italy, 1904. (Agrost. 2373.)

16827. BROMUS UNIOLOIDES. **Rescue grass.**
(Agrost. 2448.)

16828. AGROSTIS STOLONIFERA. **Creeping bent-grass.**
(Agrost. 2323.)

16829. AGROSTIS ALBA. **Redtop.**
(Agrost. 2443.)

16830. AGROSTIS ALBA. **Redtop.**
From Milan, Italy, 1904. (Agrost. 2340.)

16831. AGROSTIS ALBA. **Redtop.**
From Naples, Italy, 1904. (Agrost. 2341.)

16832. AGROSTIS ALBA. **Redtop.**
From Rome, Italy, 1904. (Agrost. 2370.)

16833. PANICULARIA AMERICANA.
From J. M. Thorburn & Co., New York, N. Y.

16834. POA NEMORALIS. **Wood meadow grass.**
From Italy, 1904. (Agrost. 2360.)

16835. POA PRATENSIS. **Kentucky bluegrass.**
From Padua, Italy, 1904. (Agrost. 2350.)

16836. POA PRATENSIS. **Kentucky bluegrass.**
From Treviso, Italy, 1904. (Agrost. 2356.)

16837. LOLIUM PERENNE. **Perennial rye-grass.**
(Agrost. 2319.)

16838. LOLIUM PERENNE. **Perennial rye-grass.**
(Agrost. 2329.)

16839. LOLIUM PERENNE. **Perennial rye-grass.**
(Agrost. 2330.)

16840. LOLIUM PERENNE. **Perennial rye-grass.**
From Turin, Italy, 1904. (Agrost. 2344.)

16841. LOLIUM PERENNE. **Perennial rye-grass.**
From Milan, Italy, 1904. (Agrost. 2362.)

16842. LOLIUM PERENNE. **Perennial rye-grass.**
From Naples, Italy, 1904. (Agrost. 2365.)

16843. LOLIUM PERENNE. **Perennial rye-grass.**
From Florence, Italy, 1904. (Agrost. 2369.)

16844. LOLIUM PERENNE. **Perennial rye-grass.**
From Genoa, Italy, 1904. (Agrost. 2375.)

16845. LOLIUM ITALICUM. **Italian rye-grass.**
From Mantova, Italy, 1904. (Agrost. 2342.)

16846. LOLIUM ITALICUM. **Italian rye-grass.**
From Italy, 1904. Agrost. 2367.)

16821 to 16852—Continued.

16847. Lolium italicum. **Italian rye-grass.**

From Conegliano, Italy, 1904. (Agrost. 2371.)

16848. Festuca pratensis. **Meadow fescue.**

From Argentina. Peluff's collection, 1904. (Agrost. 2474.)

16849. Alopecurus pratensis. **Meadow foxtail.**

(Agrost. 2324.)

16850. Dactylis glomerata. **Orchard grass.**

From Padua, Italy, 1904. (Agrost. 2377.)

16851. Phleum pratense. **Timothy.**

From Rome, Italy, 1904. (Agrost. 2366.)

16852. Hedysarum coronarium. **Sulla.**

From Naples, Italy, 1904. (Agrost. 2397.)

16853. Oxalis ortgiesi. **Oxalis.**

From Washington, D. C. Received through the National Botanic Garden, December 21, 1905.

16854 to 16861. Sorghum vulgare. **Sorghum.**

From Berlin, Germany. Presented by the Berlin Botanical Museum. Received December 20, 1905.

Sorghum varieties from tropical Africa, as follows:

16854.	*Ovulifer.*	**16858.**	*Ovulifer.*
16855.	*Usaramensis.*	**16859.**	*Jucundus.*
16856.	*Roxburghii.*	**16860.**	*Baumannii.*
16857.	*Densissimus.*	**16861.**	*Baumannii.*

16862 to 16865.

From College Park, Md. Received through Mr. H. A. Miller, Agricultural Experiment Station, December 20, 1905.

16862. Hordeum vulgare. **Barley.**

Tennessee Winter. (C. I. No. 257.)

16863. Avena sativa. **Oat.**

Sixty-Day. (C. I. No. 165.)

16864. Avena sativa. **Oat.**

Snoma. (C. I. No. 274.)

16865. Avena sativa. **Oat.**

Burt. (C. I. No. 293.)

16866. Dioscorea trifida. **Yampee yam.**

From the Canal Zone. Presented by Mr. George F. Halsey. Received December 27, 1905.

"Roots of a variety apparently distinct from the Jamaica and Porto Rico varieties. This variety should be cultivated in hills and is said to be very productive. The roots are yellowish inside." (*Barrett.*)

16867. Syncarpia laurifolia. **Turpentine tree.**

From Melbourne, Australia. Presented by Prof. W. R. Guilfoyle, director of the Botanic Gardens. Received December 29, 1905.

16867—Continued.

"A tree 100 to 150 feet high with diameter 4 to 5 feet; native of the tropical coast regions of New South Wales and Queensland. Valuable timber tree, especially for posts and underground situations; also for piles, as the resinous matter contained in the wood makes it resistant to damp, the attacks of white ants, and the Teredo. Entirely unprotected piles exposed to the waves for twelve years were found absolutely free from decay and the attacks of the Teredo. The wood is also difficult and slow to burn, a useful property in building lumber. An oleo-resin, in degree and character something between Venice turpentine and Canada balsam, contained in the wood is best collected by felling the tree, when it exudes between the bark and sapwood in small drops, which may be scraped off and the resin collected in a pure state." (*J. H. Maiden.*)

16868. CEROPEGIA FUSCA.

From Grand Canary, Canary Islands. Presented by Mr. Alaricus Delmard. Received December 21, 1905.

16869. CYNARA SCOLYMUS. **Artichoke.**

From Paris, France. Received through Vilmorin-Andrieux & Co., December 29, 1905.

Seed of the *Globe* or *Paris* artichoke.

16870. DIOSPYROS sp. **Sapote negro.**

From Uruapan, Michoacan, Mexico. Presented by Mr. C. G. Pringle. Received December 22, 1905.

16871. PERSEA GRATISSIMA. **Avocado.**

From Miami, Fla. Presented by Mr. S. B. Bliss. Received December 18, 1905.

Trapp.

16872. CITRUS TRIFOLIATA × AURANTIUM. **Citrange.**

From the Plant Breeding Laboratory. Received December 22, 1905.

Trees of the *Morton* citrange, a hybrid between the trifoliate and the sweet orange, developed by Dr. H. J. Webber. (P. B. L. No. 771.)

16873 to 16899.

From Brunswick, Germany. Presented by the Ducal Botanic Gardens. Received December 21, 1905.

A collection of seeds, mostly grass and leguminous forage plants, as follows:

16873. MEDICAGO APICULATA.
16874. MEDICAGO ECHINUS.
16875. MEDICAGO MUREX.
16876. MEDICAGO ORBICULARIS.
16877. MEDICAGO SCUTELLATA.
16878. MEDICAGO TEREBELLUM.
16879. MEDICAGO TRIBULOIDES.
16880. ONOBRYCHIS CHRISTA-GALLI.
16881. ONOBRYCHIS CAPUT-GALLI.
16882. LATHYRUS OCHRUS.
16883. PISUM ELATIUS.
16884. PISUM ARVENSE.
16885. PISUM SATIVUM.
16886. SCORPIURUS SULCATA.
16887. SCORPIURUS MURICATA.
16888. SCORPIURUS VERMICULATA.
16889. SCORPIURUS SUBVILLOSA.
16890. ERODIUM GRUINUM.
16891. ERODIUM MALACHOIDES.
16892. AVENA BREVIS.
16893. AVENA SATIVA DIFFUSA.
16894. AVENA SATIVA DIFFUSA.
16895. AGROPYRON PUNGENS.
16896. BROMUS BRACHYSTACHYS.
16897. BROMUS STERILIS.
16898. HORDEUM AEGICERAS.
16899. HORDEUM ZEOCRITON.

16900. CEPHALARIA TATARICA.

From Stockholm, Sweden. Presented by the Albano Botanic Gardens. Received December 21, 1905.

16901 to 16908.

From Saharanpur, India. Presented by Prof. H. M. Leake, economic botanist, Government Botanic Gardens. Received December 21, 1905.

Grass seeds, as follows:

16901. SYNTHERISMA SANGUINALIS. **Finger grass.**

16902. PANICUM TRYPHERON. **Guinea grass.**

16903. PASPALUM DILATATUM. **Large water grass.**

16904. CHAETOCHLOA GLAUCA. **Yellow foxtail.**

16905. EUCHLAENA MEXICANA. **Teosinte.**

16906. ELEUSINE AEGYPTIACA.

16907. ANDROPOGON PERTUSUS.

16908. ANDROPOGON HALEPENSIS. **Johnson grass.**

16909 to 16927.

From near Peking, China. Received through Mr. Frank N. Meyer, December 26, 1905.

Cuttings of various fruit trees, grapevines, and ornamentals, as follows:

16909. ULMUS sp. **Elm.**

From Nankou. "(No. 31.) A broad-leaved elm suitable for small gardens and parks." (*Meyer.*)

16910. DIOSPYROS KAKI. **Persimmon.**

From Ming Tombs Valley. "(No. 97.) A small, seedless persimmon, with bright, orange-red fruits attaining 2 inches in diameter; later in ripening than the large ones (S. P. I. No. 16912) and not so good. The trees, however, grow to a larger size, and with their leaves dropped off and loaded with orange-colored fruits are very ornamental. Before falling the leaves also assume beautiful colors." (*Meyer.*)

16911. PYRUS SINENSIS. **Pear.**

From Tcha-ching. "(No. 120.) A fine, white pear with melting flesh; is one of China's finest pears. Comes in late, but, being a poor keeper, disappears very early from the markets." (*Meyer.*) (Same as S. P. I. No. 16916.)

16912. DIOSPYROS KAKI. **Persimmon.**

From Ming Tombs Valley. "(No. 104.) A most valuable fruit. The bright, orange-colored fruits attain a diameter of 4½ inches and are perfectly seedless. Bears shipping extremely well if picked when not quite ripe. Can be kept frozen hard if picked too ripe, and if care is taken can be shipped long distances. Finally, their taste is delicious and they would be highly esteemed in America as a table fruit." (*Meyer.*) (See also S. P. I. No. 16921.)

16913. DIOSPYROS KAKI. **Persimmon.**

From Ming Tombs. "(No. 33.) A larger variety of seedless persimmon than is generally seen, but the fact that they grew on a young tree may account for this. It ripens, however, a fortnight later than those sent in under Nos. 16912 and 16921; otherwise the same description applies to it." (*Meyer.*)

16914. CATALPA BUNGEI. **Catalpa.**

From Peking. "(No. 13.) The real *Catalpa bungei*. A fine tree, said to be covered in spring with pink-white flowers; a favorite tree in old temple yards. This one comes from the Yellow Temple, a short distance north of Peking." (*Meyer.*)

16909 to 16927—Continued.

16915. POPULUS sp. **Poplar.**

From Hwai-jou. "(No. 15.) This poplar seems to be a favorite tree for temple yards; it grows to a very large size, has a straight trunk with branches trimmed high from the ground and with large, dark green leaves. It will be much appreciated as an avenue or park tree." (*Meyer.*)

16916. PYRUS SINENSIS. **Pear.**

From Tcha-ching. (No. 109.) For description see No. 16911.

16917. PRUNUS ARMENIACA. **Apricot.**

From Shan-hai-kwan. "(Nos. 28 and 29.) A wild apricot with small fruits; apparently grows wild in a few cañons." (*Meyer.*)

16918. PRUNUS sp. **Cherry.**

From Tang-shan. "(No. 93.) Apparently a cherry which grows in bush-like form, much resembling a red currant bush. According to the Chinese, the fruits are small but sweet, ripening in early June." (*Meyer.*)

16919. AMYGDALUS PERSICA. **Peach.**

From Shan-hai-kwan. "(No. 32.) A wild peach found near an old monastery, but occurring in many different places—probably escaped from cultivation." (*Meyer.*)

16920. MORUS ALBA. **Mulberry.**

From Ming Tombs. "(No. 92.) A form with very deeply cut leaves, which appear to be decidedly different from the common type." (*Meyer.*)

16921. DIOSPYROS KAKI. **Persimmon.**

From Ming Tombs Valley. "(Nos. 104 and 105.) These trees are grafted upon wild stock and are planted 20 to 30 feet apart. Being slow growers, peaches are planted between the young trees and afterwards taken out when the persimmons need the space. They seem to love a somewhat sheltered position in the foothills of the mountains in a soil made of decomposed rock." (*Meyer.*)

16922. FRAXINUS sp. **Ash.**

From Shan-hai-kwan. "(No. 11.) A decidedly ornamental shade tree; grows in dry situations." (*Meyer.*)

16923. MORUS ALBA. **Mulberry.**

From Ming Tombs. "(No. 91.) Another form with deeply laciniated leaves." (*Meyer.*)

16924. PYRUS SINENSIS. **Pear.**

From Tcha-ching. "(No. 119.) An attractive, medium-sized white pear with a long stem and nonmelting flesh; much relished by the Chinese." (*Meyer.*)

16925. POPULUS sp. **Poplar.**

From Kaulitang. "(No. 38.) This poplar thrives in sandy soil and is planted largely on sandy wastes where no other tree would flourish. The Chinese use the wood in building houses, coffins, etc. A rather ornamental tree with silvery bark." (*Meyer.*)

16926. POPULUS sp. **Poplar.**

From Chang-li. "(No. 30.) A very large poplar with a straight, smooth trunk; well fitted for park or avenue planting." (*Meyer.*)

16927. VITIS sp. **Grape.**

From Hsuen-hwa-fu. "(Nos. 102, 106, and 107.) A fine white grape, berries very long and in heavy bunches; commands high prices and is really a fine table grape; can be kept in paper-lined baskets in a cool place until Chinese New Year (early February)." (*Meyer.*)

16928. Vicia sp. **Vetch.**

From Thomas, Oreg. Presented by Mr. S. W. Gaines. Received December, 1905.

16929 and 16930. Quercus spp. **Truffle oaks.**

From Paris, France. Received through Vilmorin-Andrieux & Co., December 30, 1905.

16929. Quercus ilex. **Holly oak.**

16930. Quercus pubescens.

Trees introduced for truffle culture.

16931 to 16939.

From St. Louis, Mo. Received through the Missouri Botanical Gardens, January 2, 1906.

A collection of roots, as follows:

16931. Maranta kegeljani.

16932. Calathea princeps.

16933. Calathea crotalifera.

16934. Calathea sp.

16935. Calathea ornata sanderiana.

16936. Calathea oppenheimiana.

16937. Calathea vittata.

16938. Colocasia neo-guineensis.

16939. Maranta leuconeura kerchoviana.

16940 to 16944.

From Chico, Cal. Grown at the Plant Introduction Garden in 1905. Received December 22, 1905.

Seeds, as follows:

16940. Arachis hypogaea. **Peanut.**

Grown from No. 4253.

16941. Arachis hypogaea. **Peanut.**

Grown from No. 9406.

16942. Voandzeia subterranea. **Woandzu.**

Grown from No. 10450.

16943. Arachis hypogaea. **Peanut.**

Grown from No. 10622.

16944. Arachis hypogaea. **Peanut.**

Grown from No. 11140.

16945 to 16948.

From Victoria, Kamerun, Africa. Received through Mr. H. Nehrling, Gotha, Fla., January 3, 1906.

16945. Amomum melegueta. **Paradise seed.**

"Native of tropical western Africa. This plant belongs to the ginger family. From a long, scaly rootstock there are produced leafy branches and short, leafless, flower-bearing branches bearing a single white-purple flower. The fruit is red, large, fleshy, and pear-shaped, containing a large number of brown seeds called paradise seed or Guinea grains. Used only in veterinary medicine and in adulterating liquors and pepper." (*Wheeler.*)

16946. Xanthosoma sp. **Yautia.**

"*Xanthosoma violaceum;* cultivated." (*Nehrling.*)

16945 to 16948—Continued.

16947. XANTHOSOMA sp. **Yautia.**

"With light green petioles; cultivated." (*Nehrling.*)

16948. XANTHOSOMA sp. **Yautia.**

"*Colocasia antiquorum;* cultivated." (*Nehrling.*)

16949 to 16979.

From Paris, France. Received through Vilmorin-Andrieux & Co., December 29, 1905.

A collection of seeds, as follows:

16949. ARRHENATHERUM ELATIUS. **Tall oat-grass.**

16950. TRISETUM PRATENSE.

16951. AVENA PUBESCENS. **Downy oat-grass.**

16952. ANTHRISCUS SYLVESTRIS.

16953. BRACHYPODIUM PINNATUM.

16954. BRACHYPODIUM SYLVATICUM.

16955. BROMUS INERIMS. **Smooth brome-grass.**

16956. CORONILLA VARIA. **Crown vetch.**

16957. CYTISUS PROLIFERUS ALBUS. **Broom.**

16958. DACTYLIS GLOMERATA. **Orchard grass.**

16959. FESTUCA DUMETORUM.

16960. FESTUCA ELATIOR. **Tall fescue.**

16961. FESTUCA HETEROPHYLLA. **Various-leafed fescue.**

16962. FESTUCA OVINA. **Sheep's-fescue.**

16963. FESTUCA PRATENSIS. **Meadow fescue.**

16964. FESTUCA RUBRA. **Red fescue.**

16965. FESTUCA TENUIFOLIA. **Slender-leafed fescue.**

16966. HOLCUS MOLLIS. **Creeping soft-grass.**

16967. MELICA CILIATA.

16968. MELICA COERULEA.

16969. MELILOTUS ALBA. **White melilot.**

16970. PASPALUM STOLONIFERUM.

16971. PHALARIS ARUNDINACEA. **Reed canary grass.**

16972. PHLEUM PRATENSE. **Timothy.**

16973. POA COMPRESSA. **Canadian bluegrass.**

16974. POA FERTILIS.

16975. POA SUDETICA.

16976. STIPA TENACISSIMA. **Esparto grass.**

16977. TRIFOLIUM INCARNATUM. **Crimson clover.**

16978. TRIFOLIUM INCARNATUM. **Crimson clover.**

Late.

16979. TRIFOLIUM INCARNATUM. **Crimson clover.**

Extra late; white flowering.

16980 to 16984. ORYZA SATIVA. **Rice.**

From Sivaganga, Madura district, South India. Received through Mr. A. P. Minor, January 4, 1906.

16980.

Jeeragasamba. "(No. 1.) An elegant, very small-sized rice of exceptional whiteness when properly cleaned. It requires an old, well-cultivated soil and will then yield, say, 3,000 pounds per acre or more according to manure applied. The straw is finer and less tough than that of the commoner kinds of paddy and hence is especially valuable as fodder. In good soil it is a 4½ to 5 months' crop." (*Minor.*)

16981.

Varikarudan. (No. 2.)

16982.

Milagi. "(No. 3.) Nos. 2 and 3 give fine white rice, preferred to all others by the higher classes in this part of India. The flavor is supposed to be exceptionally good. Both are hardy and require no exceptional treatment. In an average soil they yield 3,000 pounds per acre and in a well-manured soil up to 5,000 pounds per acre. The straw is good fodder for cattle. The duration of crop is ordinarily 4½ to 5½ months." (*Minor.*)

16983.

Vellakattai, or *Sirumanian.* (No. 4.)

16984.

Erangal, or *Naryan.* "(No. 5.) Nos. 4 and 5 yield a large white rice which is considered particularly nourishing by the lower classes; very hardy, vigorous grower, even in a comparatively poor soil. An ordinary outturn, with little or no manure, is 2,500 pounds per acre, which may be nearly doubled by manuring. The straw is coarser than that obtained from Nos. 2 and 3. The crop matures in 3½ to 4 months, according to soil and other conditions." (*Minor.*)

16985 to 17034.

From Erfurt, Germany. Received through Haage & Schmidt, December 28, 1905.

Seeds of forage crops, as follows:

16985. ASTRAGALUS FALCATUS.
16986. AVENA FLAVESCENS.
16987. BROMUS PRATENSIS.
16988. DACTYLIS GLOMERATA.
16989. FESTUCA ARUNDINACEA.
16990. FESTUCA DURIUSCULA.
16991. FESTUCA ELATIOR.
16992. FESTUCA HETEROPHYLLA.
16993. FESTUCA OVINA.
16994. FESTUCA PRATENSIS.
16995. FESTUCA RUBRA.
16996. FESTUCA TENUIFOLIA.
16997. LUZULA ALBIDA.
16998. LATHYRUS HIRSUTUS.
16999. MELILOTUS COERULEA.
17000. MELILOTUS ALTISSIMA.
17001. MELILOTUS OFFICINALIS.
17002. MELILOTUS PARVIFLORA.
17003. MELILOTUS SEGETALIS.
17004. MELILOTUS SULCATA.
17005. PHALARIS ARUNDINACEA.
17006. PISUM JOMARDI.
17007. PLANTAGO PSYLLIUM.
17008. SPARTIUM SCOPARIUM.
17009. VICIA AGRIGENTINA.
17010. VICIA AMBIGUA.
17011. VICIA BIENNIS.
17012. VICIA CALCARATA.
17013. VICIA CASSUBICA.
17014. VICIA CORDATA.
17015. VICIA CORNIGERA.
17016. VICIA CUSPIDATA.

16985 to 17034—Continued.

17017. Vicia disperma.
17018. Vicia ferruginea.
17019. Vicia gerardi.
17020. Vicia globosa.
17021. Vicia grandiflora.
17022. Vicia hybrida.
17023. Vicia lutea.
17024. Vicia macrocarpa.
17025. Vicia multiflora.
17026. Vicia onobrychioides.
17027. Vicia pannonica.
17028. Vicia peregrina.
17029. Vicia picta.
17030. Vicia pseudo-cracca.
17031. Vicia sylvatica.
17032. Vicia spuria.
17033. Vicia striata.
17034. Vicia tricolor.

17035 to 17050.

From Sydney, New South Wales. Presented by Prof. J. H. Maiden, director of Botanic Gardens. Received January 2, 1906.

17035. Andropogon bombycinus.
17036. Astrebla pectinata.
17037. Astrebla elymoides.
17038. Cenchrus australis.
17039. Chloris truncata.
17040. Chloris ventricosa.
17041. Chrysopogon gryllus.
17042. Panicum decompositum.
17043. Panicum prolutum.
17044. Paspalum brevifolium.
17045. Pennisetum compressum.
17046. Pollinia fulva.
17047. Chaetochloa aurea.
17048. Sporobolus lindleyi.
17049. Stipa elegantissima.
17050. Stipa tuckeri.

17051 and 17052. Bouteloua spp.

From Silver City, N. Mex. Received through Mr. James K. Metcalfe, January 5, 1906.

17051. Bouteloua curtipendula. **Tall grama grass.**
17052. Bouteloua oligostachya. **Blue grama grass.**

17053. Solanum commersoni. Aquatic potato.

From Burlington, Vt. Received through Prof. William Stuart, of the Agricultural Experiment Station, January 6, 1906.

Tubers grown from stock obtained through Dr. Edouard Heckel, of Marseille, France. "Heckel is not at all of the opinion that *Solanum commersonii* should replace our common potato; but if it is adapted to swampy locations it would become very valuable to us, and possibly nonbitter hybrids might be produced for poorly drained soils by cross fertilization." (*L. Wittmack, Gartenflora, 54: 452, 1905.*) (See note to No. 10324.)

17054. Solanum commersoni. Aquatic potato.

From Santa Rosa, Cal. Received through Mr. Luther Burbank, November 28, 1905, and February 10, 1906.

Tubers grown from No. 10324. "Has rather small vines, produces an enormous amount of flowers all summer and a reasonable amount of seed balls, which, however, unless pollenized from some other variety never produce a seed. Owing to its wandering disposition, not extra quality, and not being very productive it will never become popular. I judge from what I have read in the French papers that the bluish variety is better." (*Burbank.*)

17055 to 17058.

From Buitenzorg, Java. Presented by Doctor Treub, director of the Department of Agriculture. Received January 5, 1906.

17055. ARACHIS HYPOGAEA. **Peanut.**
"*Katjang holle.*"

17056. ARACHIS HYPOGAEA. **Peanut.**
"*Katjang banah waspada.*"

17057. ARACHIS HYPOGAEA. **Peanut.**
"*Katjang amerika.*"

17058. VOANDZEIA SUBTERRANEA. **Woandzu.**
"*Katjang bogor.*"

17059. FESTUCA PRATENSIS. Meadow fescue.

From Marysville, Kans. Received through Mr. Frank W. Oakley, January 5, 1906.

17060 and 17061.

From Honolulu, Hawaii. Received through Dr. J. N. Rose, of the United States National Museum, Washington, D. C., December 29, 1905.

Seeds, as follows:

17060. OREODOXA REGIA. **Royal palm.**

(No. 05/876.)

17061. ARISTOLOCHIA sp.

(No. 05/875.)

17062. SOLANUM MELONGENA. Eggplant.

From Trebizond, Turkey. Presented by Mr. Vital Ojalvo, vice-consul, through Mr. Frank Benton. Received January 6, 1906.

Seed of a violet-colored variety.

17063 to 17066.

From Moscow, Russia. Presented by Prof. William R. Williams, of the Moscow Agricultural Institute. Received January 8, 1906.

17063. ALOPECURUS RUTHENICUS.

17064. BROMUS MOLLIS.

17065. BROMUS RACEMOSUS.

17066. BROMUS SYLVATICUS.

17067 and 17068.

From Paris, France. Received through Vilmorin-Andrieux & Co., January 9, 1906.

17067. MELILOTUS COERULEA. **Blue sweet clover.**

17068. CORONILLA SCORPIOIDES.

17069 and 17070.

From Dreshertown, Pa. Received through Thomas Meehan & Sons, January 9, 1906.

Stocks upon which to graft imported cuttings, as follows:

17069. MALUS MALUS. **Apple**

17070. PYRUS COMMUNIS. **Pear.**

17071. PANICUM LAEVIFOLIUM.

From Pretoria, Transvaal, South Africa. Presented by Prof. J. Burtt Davy, agrostologist and botanist of the Department of Agriculture. Received January 9, 1906.

17072 to 17075. ELEUSINE CORACANA.

From Bombay Presidency, India. Received through Mr. F. Fletcher, Deputy Director of Agriculture, January 9, 1906.

17072. "*Mukti Nagli.*" (Close heads.) From Lonawla.

17073. "*Zipri Nagli.*" (Open heads.)

17074. "*Nagli.*" (Red.)

17075. "*Nagli.*" (White.)

17076 to 17092.

From Paris, France. Received through Vilmorin-Andrieux & Co., January 9, 1906.

Seeds of forage crops, as follows:

17076.	ANTHYLLIS VULNERARIA.	**Kidney vetch.**
17077.	ASTRAGALUS FALCATUS.	**Milk vetch.**
17078.	BRASSICA OLERACEA.	**Improved branching borecole.**
17079.	BRASSICA OLERACEA.	**Thousand-headed kale.**
17080.	CYTISUS SCOPARIUS.	**Common broom.**
17081.	FESTUCA DUMETORUM.	
17082.	FESTUCA HETEROPHYLLA.	**Various-leafed fescue.**
17083.	FESTUCA OVINA.	**Sheep's-fescue.**
17084.	FESTUCA RUBRA.	**Red fescue.**
17085.	FESTUCA TENUIFOLIA.	**Slender-leaved fescue.**
17086.	LOTUS VILLOSUS.	**Greater bird's-foot trefoil.**
17087.	MEDICAGO MEDIA.	**Sand lucern.**
17088.	POA FERTILIS.	
17089.	POA NEMORALIS.	**Wood meadow grass.**
17090.	POA SEMPERVIRENS.	
17091.	POA TRIVIALIS.	**Rough-stalked meadow grass.**
17092.	ULEX EUROPAEUS.	**Furze, gorse, or whin.**

17093. CHRYSOPHYLLUM CAINITO. **Star-apple.**

From Washington, D. C. Plants grown in the Department greenhouse from seed obtained in 1904 by Mr. G. N. Collins in Jamaica, British West Indies; numbered January 10, 1906.

Fruit from which seeds were obtained was large and light colored.

17094 and 17095. ERAGROSTIS ABYSSINICA. **Teff.**

From Abyssinia. Received through His Excellency S. A. Ras Makomen, January 12, 1906.

17094. Pearl white seed. 17095. Brown seed mixed with white.

"Teff is the staple food of the Abyssinians. Considering the general physique of the nation and that teff is practically the sole means of nourishment, as the poorer classes seldom taste meat, the cereal is undoubtedly rich in nitrog-

17094 and 17095—Continued.

enous matter. It possesses, too, a sufficient quantity of starchy matter to constitute a fairly hygienic diet. Teff is utilized as follows: Ground into flour; made into a semiliquid or thin paste consistency by adding water, and placed in earthen jars. The leaves of the 'Geaho' (gesho) plant, which yield a ferment, are added. When fermentation is complete the sirupy mixture is slowly poured on the surface of well-heated, circular, flat baking pans. After a certain amount of manipulation and turning over, a semiaerated, flat, round cake is the result. This keeps for months without deterioration, is broken into fragments and dried in the sun. The dried bread is used as their chief supply when at war or on expeditions. Teff undoubtedly possesses highly nutritious qualities and is decidedly more digestible than wheat. It could therefore be exploited as an invalid food. Teff is not known to possess distinct drought-resisting properties." (*Extract from letter from the British consul at Adis Ababa, Abyssinia.*)

17096. PHASEOLUS RADIATUS. **Mung bean.**

From Augusta, Ga. Received through the N. L. Willet Seed Company, January 12, 1906.

Newman.

17097 to 17100.

From Channing, Tex. Received through Mr. A. H. Leidigh, January 12, 1906.

17097. TRITICUM DURUM. **Macaroni wheat.**

Galgalos. Grown from No. 9872.

17098. TRITICUM DICOCCUM. **Black emmer.**

Grown from No. 11650.

17099. PANICUM MILIACEUM. **Broom-corn millet.**

Black Voronezh. Grown from No. 9425.

17100. HORDEUM VULGARE. **Barley.**

Tennessee Winter. Grown from No. 11193.

17101 to 17103.

From Sibpur, Calcutta, India. Received through Mr. A. Gage, acting superintendent, Royal Botanic Gardens, January 13, 1906.

A collection of tubers, as follows:

17101. AMORPHOPHALLUS CAMPANULATUS. **Stanley's washtub.**

The members of this genus of aroids are natives of India and other parts of tropical Asia, where they are cultivated for the starch which is so abundant in the rootstock. *Amorphophallus campanulatus* has a tuber weighing 8 to 10 pounds, shaped like a flat cheese; spathe nearly 2 feet broad and 15 inches high, with a horizontal, spreading, fluted border, red-purple on the border, then grayish white spotted and purple in the center. Doctor White says of it that when in flower the fetor it exhales is most overpowering, and so perfectly resembles that of carrion as to induce flies to cover the club of the spadix with their eggs.

17102. COLOCASIA ANTIQUORUM ESCULENTA (?)

(Labeled "*Alocasia antiquorum.*")

17103. ALOCASIA INDICA. **Alocasia.**

"These roots are cultivated to some extent throughout India, but do not occupy so important a place in the domestic economy there as do the taros in Polynesia or the yautias in tropical America." (*Barrett.*)

17104. PHALARIS CANARIENSIS. **Canary grass.**

From Malta. Received through Mr. J. Borg, of the St. Antonio Gardens, January 15, 1905.

Malta canary seed. "Requires the same culture as the late varieties of wheat. Very productive and remunerative, although not much grown in Malta. The grain is slightly larger in size than the best Sicilian canary seed; the plant is also stouter." (*Borg.*)

17105. CINNAMOMUM CAMPHORA. **Camphor.**

From Paris, France. Received through Vilmorin-Andrieux & Co., January 15, 1906.

This plant is the source of camphor, the gum being obtained from the extracted juice. The tree is difficult to transplant and is best propagated by seeds, sown as soon as ripe in a shaded bed, the seedlings being transplanted when very small into pots and kept thus until ready to plant out permanently. The soil best suited to camphor is a sandy loam.

17106 to 17130. AMYGDALUS COMMUNIS. **Almond.**

From Girgenti, Italy. Received through Hon. Francis Ciotta, United States consular agent, January 15, 1906.

Almond cuttings, as follows:

17106.

Cornutella. This is a plant requiring special care, but is highly valued for its sweet and agreeable flavor. The tree will attain a vigorous and strong growth; can be cultivated in all climates.

17107.

Cavaliera. In this the vegetation is especially vigorous, resists frost, yields well, and the fruit is extremely tender, being much sought after as a table fruit.

17108.

Caccia. In this the vegetation is extremely strong, resists the rigors of winter, produces richly, and is incomparable for roasting and for making the finest torroni, the tower-like almond cakes made of almonds and honey.

17109.

Bianca. The tree is of medium development, wood not very solid, yields well, fruit extremely sweet and highly valued for table use.

17110.

Selvaggia. This tree has great resistance, grows in a very luxuriant manner and regular form; bears a tender fruit used by preference for the ordinary torroni, almond cakes of the common quality.

17111.

Carina. This tree is of medium development and is very resistant to frost and inclement weather. It produces abundant small, tender fruit which is excellent for pastry and for the almond paste.

17112.

Regaliana. This tree is of medium size and of ordinary resistance; produces abundantly a fruit valuable for the table, exquisitely sweet and sought for in all the markets for its excellent qualities.

17113.

Inglese. This takes its name from the extensive use to which it is put in the manufacture of special pastes in England. It is very delicate and tender, superior for the table and excellent also for making sweetmeats.

17106 to 17130—Continued.

17114.

Tramontana. Its resistance to frost, which is strong in this almond tree, enables it to grow vigorously in the tramontane regions without injury from exposure to those northern winds. The fruit is sweet and sought after for confectionery.

17115. *Washington.*

17116. *Sicilia.*

17117. *Racalmuto.*

17118. *Signora.*

17119. *Mantia.*

17120. *Gioia.*

17121. *Sanfilippo.*

17122. *Striata.*

17123. *Sanguisuga.*

17124. *Fra Elia.*

17125. *Milocca.*

17126. *Kruger.*

17127. *Gioglio.*

17128. *Nocciola.*

17129. *Rocca Rossa.*

17130. *Giapponese.*

17131. ELYMUS VIRGINICUS SUBMUTICUS. **Wild rye-grass.**

From Union, Oreg. Received through Mr. George Gammie, of the Agricultural Experiment Station, January 13, 1906.

A native of the Rocky Mountains. A coarse, perennial grass, growing on alluvial river banks or in rich low grounds. This grass frequently forms a considerable portion of native meadow lands and makes a coarse hay. It starts growth early in the spring and thus affords a good pasturage.

17132. SOLANUM COMMERSONI. **Aquatic potato.**

From New York, N. Y. Received through J. M. Thorburn & Co., January 15, 1906.

Violet tubers procured direct from Mr. J. Labergerie, and will be compared with the form imported direct from Heckel and the forms received from Luther Burbank. (For description see "Le Solanum Commersonii et ses Variations Pomme de Terre de L'Uruguay (Variete Violette)," by J. Labergerie.)

17133. SECHIUM EDULE. **Chayote.**

From South Island, S. C. Received through Gen. E. P. Alexander, January 12, 1906.

17134. PHASEOLUS RADIATUS. **Mung bean.**

From Chillicothe, Tex. Received through Mr. A. B. Conner, December 23, 1905.

Udid. Grown from No. 8541.

17135 to 17137. ORYZA SATIVA. **Rice.**

From Yokohama, Japan. Received through the Yokohama Nursery Company, January 9, 1906.

Japanese rice grown in Shizuoka Ken district, as follows:

17135. *Tamanishiki.*

17136. *Araki.*

17137. *Mochi.* A glutinous variety mostly used for cakes, candy, etc.

17138 to 17140.

From Manila, P. I. Received through Mr. W. S. Lyon, horticulturist, Bureau of Agriculture, January 16, 1906.

17138. LILIUM PHILIPPINENSE. **Benguet lily.**

"Its grassy foliage is striking and graceful. It forces here admirably, and I think should be a good subject for a forcing bulb in cultivation." (*Lyon.*)

17139. STERCULIA FOETIDA.

"*Bobug.*" A tall, handsome, smooth tree with whirled horizontal branches, large compound leaves, and large, dull red flowers appearing with the leaves in spreading panicles. The fruit consists of five large follicles, containing 10 to 15 smooth, black seeds the size of filberts, which are roasted and eaten like chestnuts. Native throughout the tropics of the Old World.

17140. ACTINORHYTIS CALAPPARIA. **Palm.**

"One of the most attractive palms of the Areceae group that I have ever seen. I think it would prove a useful subject for house decorations, as our native gardeners grow it to a large size (8 to 10 feet) in flat, shallow, 12-inch pans." (*Lyon.*)

17141. GARCINIA MORELLA. **Gamboge.**

From Kingston, Jamaica, British West Indies. Received through Dr. W. Fawcett, director of Hope Gardens, January 18, 1906.

Seeds obtained for the purpose of propagating seedling stocks upon which to graft the mangosteen.

17142 and 17143. PASSIFLORA spp.

From Washington, D. C. Plants grown on the grounds of the Department of Agriculture, and numbered for convenience in recording distribution on January 18, 1906.

17142. PASSIFLORA RACEMOSA. **Passion flower.**

17143. PASSIFLORA QUADRANGULARIS VARIEGATA. **Granadilla.**

17144. ORYZA SATIVA. **Rice.**

From North Galveston, Tex. Received through Dr. S. A. Knapp, January 15, 1906.

Egyptian. "The *Egyptian* rice is locally known in Louisiana as *Bull* rice and has been grown there for a great many years. It has a large berry of the Japanese type—that is, thick and short kernel—somewhat larger than the *Kiushi* rice, dark colored and much softer when it first ripens, so that it answers excellently for the purpose of stock food. It also has more protein than the ordinary rice. The characteristics of its growth are that it requires very little water, has a strong stalk, abundant leaf, is a heavy producer, and will generally make a crop even though the other rices fail. For these reasons it is grown in Louisiana as a stock food." (*Knapp.*)

17145. DIOSPYROS VIRGINIANA. **Persimmon.**

From Augusta, Ga. Received through the P. J. Berckmans Company, January 19, 1906.

Seedling stocks for use in grafting imported scions.

17146. GARCINIA MANGOSTANA. **Mangosteen.**

From Buitenzorg, Java. Received through Dr. M. Treub, director of the Botanical Gardens, January 19, 1906.

17147. HORDEUM DISTICHUM NUTANS. **Barley.**

From Fort Atkinson, Wis. Received through Mr. W. D. Hoard, January 17, 1906.

Hanna.

17148. AVENA SATIVA. **Oat.**

From Brandon, Wis. Received through Mr. David Jones, January 20, 1906.

Kherson.

17149. XANTHOSOMA sp. **Yautia.**

From Linares, Nueva Leon, Mexico. Presented by Dr. F. Franceschi, Santa Barbara, Cal. Received January 22, 1906.

Linares.

17150. REHMANNIA ANGULATA.

From Narberth, Pa. Received through Mr. William Tricker, January 19, 1906.

"Introduced by James Veitch & Son, London, England. A native of central China; has proved hardy on the Cotswold Hills, England, 750 feet above sea level, without protection; and with moderate protection withstood the severe winter of 1904–5 in Massachusetts. Awarded certificate of merit at Royal Horticultural Society in 1903 Seedlings raised in the spring of 1905, which were planted out under similar conditions with other herbaceous plants, made rapid progress and some commenced to flower in July and were still in flower October 19. Others probably will not flower until 1906, exhibiting more the character of biennials. The plants are vigorous, leaves radical laciniate, of a deep green color and 12 to 15 inches long. Some plants sent up one spike from the main crown, while others sent up several spikes but weaker. Main spikes have produced lateral growths with flowers. Several spikes were 4 feet tall. Flowers like *Bignonia grandiflora* (except in color) are produced at the axils of the leaves. Size, 3 inches in diameter, color, rose-purple with a rich yellow throat spotted with purple. The individual flower resembles *Incarvillea delavayi*. Plants thrive in ordinary garden soil; should have full sunshine and ample space between plants—about 2 feet. Flowers are good for cutting, remaining several days in good condition." (*Tricker.*)

17151. CITRUS AURANTIUM. **Orange.**

From Siang-tan, Hunan Province, China. Received from Mr. S. A. McCalla, through Prof. H. A. Morgan, director of the Agricultural Experiment Station, Knoxville, Tenn., January 17, 1906.

Orange seeds said by Doctor Webber to be of a tangerine type.

"The oranges grown hereabouts are of both the loose-skinned and the tight-skinned varieties. None of them are especially good. The town of Li-ling, which has a latitude of 27° 42′ N., is the northern limit of the tight-skinned oranges, but the loose-skinned variety grows as far north as Chang-sha, which is probably about 400 feet above sea level. Nearly every winter there are one or two big snows. I have seen two in the last five years about 9 inches deep; also, from time to time there are freezes, but the orange trees never seem to suffer." (*McCalla.*)

17152 to 17162.

From Chi-li Province, China. Received through Mr. Frank N. Meyer, December, 1905.

Cuttings of fruits and vines, as follows:

17152. PRUNUS ARMENIACA. **Apricot.**

From Tchu-chung. "(No. 118.) This is one of the finest white apricots that grows in China, as I have been told by the natives. They describe the fruit as being very large and white skinned, with a few red spots." (*Meyer.*)

17152 to 17162—Continued.

17153. PRUNUS ARMENIACA. **Apricot.**

From Tcha-ching. "(No. 113.) The kernels of this apricot are sold as almonds; they are small but taste fine. The trees grow very bushy and are grafted upon wild stock." (*Meyer.*)

17154. PRUNUS ARMENIACA. **Apricot.**

From Tcha-ching. "(No. 112.) A large, red apricot described by the natives as being very good." (*Meyer.*)

17155. VITIS VINIFERA. **Grape.**

From Chang-li. "(No. 114.) This is a very fine white grape belonging to the *Muscat* group. In North China it commands more than three times as much money as is paid for the purple grape." (*Meyer.*)

17156. VITIS VINIFERA. **Grape.**

From Hsuen-hwa-fu. "(No. 101.) A splendid green-white grape, considèred as the best grape here in China. The berry is very long and the bunches are rather large. The taste is fresh sweet, without being too sweet. An excellent table grape. It is apparently a kind of *Muscat* grape, not being free skinned and having the same general appearance." (*Meyer.*)

17157. VITIS sp. **Grape.**

From Chang-li. "(No. 115.) A dark purple grape; a very heavy bearer. The taste is a trifle watery, but otherwise it is all right. Is a very late grape, the last which appears here on the markets. Free skin; produces very large bunches." (*Meyer.*)

17158. VITIS sp. **Grape.**

From Hsuen-hwa-fu. "(No. 103.) A small purple grape from this region, where it gets intensely cold; the vines are buried over winter." (*Meyer.*)

17159. VITIS sp. **Grape.**

From Hwai-jou. "(No. 95.) A purple grape, said to be early and of good quality." (*Meyer.*)

17160. VITIS sp. **Grape.**

From Hwai-jou. "(No. 94.) A white grape growing near Hwai-jou. I was not able to see any fruit, but am told that it is an early, sweet grape." (*Meyer.*)

17161. VITIS sp. **Grape.**

From Chang-li. "(No. 116.) A light purple colored grape; heavy bearer; large bunches; free skin. Tastes somewhat watery. Might do fine as a wine producer. Is well esteemed here on account of coming the last in season:" (*Meyer.*)

17162. (Undetermined.)

From Hwai-jou "(No. 110.) Cuttings of a vine used around here for tying grapes to the trellises. Looks like Aristolochia. Is not produced here, but comes from farther south. It is very tenacious material, admirably fit for the the purpose." (*Meyer.*)

17163 to 17166.

From Queretaro, Mexico. Received through Señor Carlos J. Urquiza, January 20, 1906.

17163. MEDICAGO SATIVA. **Alfalfa.**

17164. VICIA FABA. **Broad bean.**

17165. LENS ESCULENTA. **Lentil.**

17166. (Undetermined.)

Shotolillo.

17167 to 17181.

From Chi-li Province, China. Received through Mr. Frank N. Meyer, January 24, 1906.

A collection of cuttings, as follows:

17167. AMYGDALUS PERSICA. **Peach.**

From Tung-chow. "(No. 35.) A large, white peach, considered a fine fruit by the Chinese. Nonmelting flesh. The tree is a very thrifty grower." (*Meyer.*)

17168. CELTIS sp. **Hackberry.**

From Shan-hai-kwan. "(No. 3.) An oramental shade tree, growing in dry, rocky situations; if not too heavily attacked by gall insects is decidedly ornamental." (*Meyer.*)

17169. CORYLUS sp. **Hazelnut.**

From Shan-hai-kwan. "(No. 7.) A low shrub found on steep, rocky mountain sides. May do well as undershrub beneath tall trees." (*Meyer.*)

17170. CRATAEGUS sp. **Hawthorn.**

From Chang-li. "(No. 10.) A small-leaved Crataegus growing wild in the mountains around here. It is used as stock for *Crataegus pinnatifida.*" (*Meyer.*)

17171. CRATAEGUS PINNATIFIDA. **Hawthorn.**

From Chang-li. "(No. 9.) A very large-fruited variety of which seeds were sent to Washington under No. 57a. A remarkable ornamental tree. Is a slow grower, but has large, glossy, dark green leaves, and is loaded in fall with scarlet fruits. In China itself there is not enough of this fruit to supply the demand for making preserves." (*Meyer.*)

17172. DIOSPYROS KAKI. **Persimmon.**

From Chang-li. "(No. 4.) A medium sized, seedless persimmon. Seems to be a variety of *Diospyros kaki.* Fruit globular, 2 inches in diameter, orange color. The trees grow 30 to 40 feet high." (*Meyer.*)

17173. DIOSPYROS LOTUS. **Persimmon.**

From Chang-li. "(No. 50.) A wild persimmon on which the large seedless varieties are grafted; is itself also an ornamental tree." (*Meyer.*)

17174. POPULUS sp. **Poplar.**

From Shan-hai-kwan. "(No. 14.) A very white barked poplar which is extremely cheery in winter landscape on account of its shining white bark. Grows to a rather large-sized tree, 60 to 80 feet. Well fit for an avenue tree or to be planted in groups in parks." (*Meyer.*)

17175. POPULUS sp. **Poplar.**

From Shan-hai-kwan. "(No. 40.) A very white barked poplar, growing close to the seashore near Shan-hai-kwan. Probably the same as No. 14 (S. P. I. No. 17174), but its locality close to the sea made it look different." (*Meyer.*)

17176. PYRUS sp. **Pear.**

From Chang-li. "(No. 36.) A very small pear. The fruits do not grow larger than a small cherry. Fit perhaps as an ornamental tree." (*Meyer.*)

17177. PYRUS sp. **Pear.**

From Shan-hai-kwan. "(No. 37.) A wild pear growing in a rocky ravine." (*Meyer.*)

17178. PYRUS SINENSIS. **Pear.**

From Chang-li. "(No. 39.) A large yellow pear, nonmelting flesh. Can be kept for many months without spoiling. May be of use in crossing with better kinds." (*Meyer.*)

17167 to 17181—Continued.

17179. Salix sp. **Willow.**

From Shan-hai-kwan. "(No. 49.) A willow which is used to make strong baskets from. The bark of an older tree becomes pitch black and looks as such rather curious." (*Meyer.*)

17180. (Undetermined.)

From Shan-hai-kwan. "(No. 5.) A plant with long, fierce spines, which might make it suitable for a hedge plant; grows to be a good-sized tree." (*Meyer.*)

17181. Xanthoxylum sp. **Prickly ash.**

From Shan-hai-kwan. "(No. 12.) Probably not possible to grow from cuttings. Seeds sent to Washington, D. C., under No. 125a." (*Meyer.*)

17182 to 17234.

From Richmond, New South Wales. Received through Mr. H. W. Potts, principal of the Hawkesbury Agricultural College, January 20, 1906.

Grass seeds, as follows:

17182. Andropogon sp. **Bluestem.**

17183. Andropogon affinis. **Coast bluestem.**

17184. Andropogon sericeus. **Hairy bluestem.**

17185. Astrebla elymoides. **Coarse Mitchell grass.**

17186. Astrebla elymoides. **Coarse Mitchell grass.**

17187. Astrebla pectinata. **Mitchell grass.**

17188. Astrebla pectinata. **Mitchell grass.**

17189. Astrebla triticoides. **Mitchell grass.**

17190. Astrebla triticoides. **Mitchell grass.**

17191. Chloris acicularis. **Star grass.**

17192. Chloris ventricosa. **Windmill grass.**

17193. Chloris truncata. **Umbrella grass.**

17194. Chloris truncata. **Umbrella grass.**

17195. Chrysopogon gryllus.

17196. Deyeuxia forsteri. **Bent-grass.**

17197. Danthonia carphoides. **Oat-grass.**

17198. Danthonia carphoides. **Oat-grass.**

17199. Danthonia nervosa. **Swamp wallaby.**

17200. Danthonia nervosa. **Swamp wallaby.**

17201. Danthonia penicillata. **Wallaby grass.**

17202. Danthonia penicillata. **Wallaby grass.**

Broad-leaved form.

17203. Danthonia semiannularis. **Wallaby grass.**

17204. Danthonia penicillata var.

A broad-leaved variety.

17205. Danthonia penicillata var.

17206. Danthonia penicillata var.

17207. Danthonia penicillata.

17182 to 17234—Continued.

17208. Danthonia penicillata villosa.

17209. Danthonia penicillata.

17210. Danthonia penicillata.

17211. Danthonia semiannularis. **Wallaby grass.**

17212. Diplachne fusca. **Brown-flowered swamp-grass.**

17213. Diplachne fusca **Brown-flowered swamp-grass.**

17214. Diplachne peacockii.

17215. Eleusine aegyptiaca. **Crowfoot.**

17216. Eragrostis sp. (Probably *E. leptostachya.*)

17217. Eragrostis brownei. **Love-grass.**

17218. Eragrostis leptostachya. **Love-grass.**

17219. Eragrostis pilosa. **Weeping love-grass.**

17220. Eriochloa polystachya. **Early spring-grass.**

17221. Neurachne mitchelliana. **Mulga grass.**

17222. Panicum arachyrachus.

17223. Panicum decompositum. **Australian millet.**

17224. Panicum flavidum. **Vandyke grass.**

17225. Panicum flavidum. **Vandyke grass.**

17226. Panicum leucophaeum. **Cotton grass.**

17227. Panicum prolutum.

17228. Panicum prolutum

17229. Poa caespitosa. **Tussock poa.**

17230. Pollinia fulva. **Sugar grass.**

17231. Pappophorum commune. **Pappus grass.**

17232. Pappophorum commune. **Pappus grass.**

17233. Chaetochloa aurea. **Yellow foxtail.**

17234. Diplachne dubia. **Cane-grass.**

17235. Aralia cordata. **Udo.**

From Yokohama, Japan. Received through the Yokohama Nursery Company, January 26, 1906.

Kan udo.

17236 to 17244.

From Buitenzorg, Java. Received through Dr. M. Treub, director of the Department of Agriculture, January 26, 1906.

17236. Alocasia macrorhiza.

Malay name "Senteh."

17237 to 17244. Colocasia antiquorum. **Taro.**

17237. Variety *nigra.* Malay name "Kiempoel ietem."

17238. Variety *monorhiza atroviridis.* Malay name "Talus romah."

17239. Variety *monorhiza scripta.* Malay name "Talus soerat."

17240. Variety *monorhiza nigra.* Malay name "Talus lampoeng ietem."

17241. Variety *monorhiza nigra.* Malay name "Talus lahoen indoeng."

17236 to 17244—Continued.

17242. Variety *monorhiza bayabon.* Malay name "Talus pandan."

17243. Variety *monorhiza bayabon.* Malay name "Talus ketan."

17244. Variety *monorhiza bayabon.* Malay name "Talus kiara."

17245. ERODIUM CYGNORUM. **Stork's-bill or crow's-foot.**

From Sydney, New South Wales. Presented by the director of the Botanic Gardens through Mr. Walter S. Campbell, director of Agriculture. Received January 22, 1906.

"An annual or biennial herb with procumbent or slightly erect stems extending from 1 foot to 3 feet or more in length. This plant is widely distributed throughout the Australian continent, being found in the interior of all the colonies, and in some situations it is moderately plentiful. Its free-seeding qualities have rendered it somewhat proof against extermination. During the spring and early summer months this plant affords a rich succulent herbage, which herbivora of all descriptions are remarkably fond of. Horses will often leave good herbage to browse upon it. Pastoralists speak very highly of this plant as affording good herbage while it is in a young state. But when it is ripening its seeds it is somewhat dreaded by the sheep owner on account of the sharp pointed seed lobes, which not only attach themselves firmly to the wool but the barbed points often penetrate the skin of the animal. Notwithstanding this, however, the plant has much to recommend it as a pasture herb, for it will grow well on the poorest of soils. Many of the dry sandhills of the interior would have little vegetation on them during the early summer months if it were not for this plant. Under cultivation it produces a great amount of herbage, and if cut when it shows its flowers it is not only valuable as a green feed, but it can be made into capital hay. Taking into consideration its great productiveness, we think it might be turned into ensilage with good results. *E. cygnorum* is the only species of the genus that is endemic in Australia." (*Flora Austr., 1:297.*)

17246 and 17247. NICOTIANA SANDERAE.

From St. Albans, England. Received from Sander & Sons through J. M. Thorburn & Co., New York, N. Y., January 18, 1906.

17246. NICOTIANA SANDERAE. **17247.** NICOTIANA SANDERAE hyb.

17248 and 17249.

From Salisbury, Rhodesia, South Africa. Presented by Hon. E. Ross Townsend, Secretary for Agriculture. Received January 29, 1906.

17248. CHLORIS VIRGATA. **Rhodes-grass.**

"Regarded as a very valuable forage plant." (*Townsend.*) (See No. 9608.)

17249. PANICUM sp. **White rapoka.**

"The *rapoka* is a millet which forms the staple article of diet among Mashona natives, and the grass is considered to be excellent for making hay or ensilage. This sample is supposed to be a new and better variety recently introduced from north of the Zambesi." (*Townsend.*)

17250. PISTACIA VERA. **Pistache.**

From Saratoga, Cal. Presented by Rev. A. Fuller. Received January 29, 1906.

Large Red Aleppo.

17251 to 17280. GLYCINE HISPIDA. **Soy bean.**

From Arlington Farm, Virginia.

A collection of soy beans grown on the Arlington Farm in 1905 from seed received through the Division of Agrostology.

Black varieties:

17251. Medium early, black. Grown from Agrost. Nos. 1978, 1979, and 2033, combined.

17251 to 17280—Continued.

Black varieties—Continued.

17252. Flat, medium large, late, black; third crop from Agrost. No. 1293.

17253. Medium black; second crop from Agrost. No. 1536.

17254. Medium black, small seeded; first crop from Agrost. No. 1980.

17255. Medium black, medium early; second crop from Agrost. No. 1188.

Brown varieties:

17256. Medium, reddish brown; second crop from Agrost. No. 1542.

17257. *Brown Eda Mame*, medium early; second crop from Agrost. No. 1185.

17258. *Ogemaw*, early; first crop from Agrost. No. 1992 or S. P. I. No. 13502.

17259. Brown, early; first crop from Agrost. No. 2031.

Green varieties:

17260. *Green Samarow*, medium, medium early; first crop from Agrost. No. 1972.

17261. Large, medium, green; fourth crop from Agrost. No. 912 or S. P. I. No. 13503, first crop from Agrost. Nos. 1764 and 1971, combined.

Greenish-yellow varieties:

17262. Small, early, greenish yellow; third crop from Agrost. No. 1297.

17263. Small, medium late, greenish yellow; second crop from Agrost. No. 1539.

17264. Medium late, greenish yellow; second crop from Agrost. No. 1198.

17265. Medium late, greenish yellow; second crop from Agrost. No. 1200.

17266. Large, medium late, greenish yellow; second crop from Agrost No. 1171 or S. P. I. No. 9409.

17267. Late, large, greenish yellow; third crop from Agrost. No. 1298.

Yellow varieties:

17268. *Ito San*, medium, early, yellow; first crop from Agrost. Nos. 1973, 1974, 1975, and 1765, combined.

17269. Dwarf, early, yellow; third crop from Agrost. No. 976.

17270. Medium yellow, small seed; fourth crop from S. P. I. No. 4912, third crop from Agrost. No. 1169 or S. P. I. No. 9407, and first crop from S. P. I. No. 12399.

17271. Medium early, yellow; second crop from Agrost. No. 1194.

17272. Small, medium yellow; second crop from Agrost. No. 1538.

17273. Medium early, yellow; second crop from Agrost. No. 1197.

17274. Small, early, yellow; second crop from Agrost. No. 1199.

17275. Medium yellow, large seed; third crop from Agrost. No. 1170 or S. P. I. No. 9408, first crop from Agrost. No. 1170–2 or S. P. I. No. 12400, and third crop from Agrost. No. 1296.

17276. Medium early, yellow from Thackara; second and third crops from Agrost. No. 1299.

17277. Medium early, yellow; third crop from Agrost. No. 1295.

17278. Large, medium late, yellow; first crop from Agrost. No. 2032.

17279. Large, late, yellow; first crop from Agrost. No. 2034.

17280. Large, late, yellow; first crop from Agrost. Nos. 1976 and 1977.

17281. MEDICAGO SATIVA. **Alfalfa.**

From Deseret, Utah. Received through Mr. Frank Hinckley, January 31, 1906.

Turkestan. Grown from S. P. I. No. 991.

17282. SECHIUM EDULE. **Chayote.**

From New Orleans, La. Presented by Mr. Aristide Hopkins. Received January 31, 1906.

"Fruit of a white variety considered more delicate than the green variety." (*Hopkins.*)

17283 to 17326. PHASEOLUS spp. **Bean.**

From Arlington Farm, Virginia.

A collection of beans grown on the Arlington Farm in 1905 from S. P. I. seed.

PHASEOLUS RADIATUS. **Mung bean.**

17283. Very early. Grown from No. 1161.

17284. Very early. Grown from No. 8814.

17285. Very early. Grown from No. 9889.

17286. Larger than No. 17283. Grown from No. 6430.

PHASEOLUS sp.

17287.

PHASEOLUS RADIATUS. **Mung bean.**

17288. Larger than No. 17283. Grown from No. 10407.

17289. Medium early, medium size. Grown from No. 13394.

17290. Medium early, medium size. Grown from No. 13397.

17291. Medium early, medium size. Grown from No. 13398.

17292. Early, medium size. Grown from No. 13396.

17293. Medium early, medium large. Grown from No. 10610.

17294. Medium early, medium large. Grown from No. 9786.

17295. Early, medium large. Grown from No. 8540.

17296. Early, large. Grown from No. 8486.

17297. Smaller than others. Grown from No. 5071.

17298. Earlier and larger, but otherwise similar to No. 17297. Grown from No. 5437.

17299. Late, medium size. Grown from No. 10527.

17300. Late, large. Grown from No. 12775.

17301. Late, large. Grown from No. 13395.

17302. Medium late, large. Grown from No. 6562.

17303. Medium late. Grown from No. 6378.

17304. Late, large. Grown from No. 1385.

PHASEOLUS MAX. **Mung bean.**

17305. Medium early, small. Grown from No. 8541.

17306. Medium, poor. Grown from No. 13400.

17307. Medium, poor. Grown from No. 13401.

17308. Trailing. Grown from No. 13402.

17309. Trailing. Grown from No. 13403.

17283 to 17326—Continued.

Phaseolus calcaratus.

17310. Late, large. Grown from No. 6564.

17311. Late, medium large. Grown from No. 13380.

17312. Late, medium large. Grown from No. 13383.

17313. Late, medium size. Grown from No. 13381.

17314. Late, medium size. Grown from No. 13382.

Phaseolus angularis. **Adzuki bean.**

17315. Very early, small. Grown from No. 10523.

17316. Large, similar to No. 17315. Grown from No. 8488.

Phaseolus sp.

17317. Earlier and larger than the average. Grown from No. 13393.

17318. Medium size, medium early. Grown from No. 13392.

Phaseolus angularis. **Adzuki bean.**

17319. Medium size, medium early. Grown from No. 13391.

17320. Late, large. Grown from No. 13405.

17321. Late, large. Grown from No. 13386.

17322. Late, large. Grown from No. 13384.

17323. Late, medium large. Grown from No. 6417.

Phaseolus sp.

17324. Earlier than No. 17323, small. Grown from No. 6418.

Phaseolus angularis. **Adzuki bean.**

17325. Late, medium large. Grown from No. 8487.

Phaseolus radiatus. **Mung bean.**

17326. Smaller than the average, quite late; not promising. Grown from No. 3868.

17327 to 17436. Vigna unguiculata. **Cowpea.**

From Arlington Farm, Virginia. Crop of 1905.

17327. Black and white mottled.

17328. *Chinese Red.* Grown from Agrost. No. 979–3.

17329. *Chinese Browneye.* Grown from Agrost. No. 980–3.

17330. *Chinese Whippoorwill.* Grown from Agrost. No. 985–3.

17331. *Downs Early Ripener.* Grown from Agrost. No. 1090–2.

17332. Grown from S. P. I. No. 8354.

17333. Grown from S. P. I. No. 6431.

17334. Grown from Agrost. No. 1204–1a–1a.

17335. *Extra Early Blackeye.* Grown from Agrost. No. 1232–3 or S. P. I. No. 13456.

17336. *Early Black.* Grown from Agrost. No. 1233–1c–1b.

17337. *Early Black.* Grown from Agrost. No. 1233–1a–1a.

17338. *California Blackeye.* Grown from Agrost. No. 1231–3 or S. P. I. No. 13457.

17339. *Southdown Mottled.* Grown from Agrost. No. 1221–3.

17340. *Clay.* Grown from Agrost. No. 1255–3 or S. P. I. No. 13458.

17327 to 17436—Continued.

17341. *Browneye.* Grown from Agrost. No. 1208–3.

17342. *Taylor.* Grown from Agrost. No. 1248–3 or S. P. I. No. 13476.

17343. *Early Black.* Grown from Agrost. No. 1233–3.

17344. *Unknown.* Grown from Agrost. No. 1251–3 or S. P. I. No. 13468.

17345. *Warren's New Hybrid.* Grown from Agrost. No. 1288–3 or S. P. I. No. 13471.

17346. *Large Blackeye.* Grown from Agrost. No. 1224–3 or S. P. I. No. 13455.

17347. Grown from Agrost. No. 1204–1d–1b.

17348. *Browneye Crowder.* Grown from Agrost. No. 1209–2.

17349. *Whippoorwill.* Grown from Agrost. No. 1269–2 or S. P. I. No. 13475.

17350. *Red Ripper.* Grown from Agrost. No. 1275–3.

17351. *Clay.* Grown from Agrost. No. 1255–1a–1a.

17352. *Warren's Extra Early.* Grown from Agrost. No. 1218–3.

17353. *Unknown.* Grown from Agrost. No. 1251–1a–1a.

17354. *Old Man.* Grown from Agrost. No. 1219–3.

17355. *Large Blackeye.* Grown from Agrost. No. 1224–1c–1.

17356. *Unknown.* Grown from Agrost. No. 1251–1a–1b.

17357. Grown from Agrost. No. 1261–1c–1b.

17358. *Clay.* Grown from Agrost. No. 1255–1c–1a.

17359. *Lady,* broad whitish. Grown from Agrost. No. 1246–1b–1.

17360. Grown from Agrost. No. 1261–1a–1a.

17361. *Red Ripper.* Grown from Agrost. No. 1257–3.

17362. *Large Blackeye.* Grown from Agrost. No. 1224–1a–1a.

17363. *White Crowder* × *Whippoorwill.* Grown from Agrost. No. 1216–2.

17364. *Taylor.* Grown from Agrost. No. 1248–1a–1a.

17365. *Red Yellow-Hull.* Grown from Agrost. No. 1278–3.

17366. *Blackeye* (white giant). Grown from Agrost. No. 1210–3.

17367. *Iron.* Grown from Agrost. No. 1247–3.

17368. *Taylor.* Grown from Agrost. No. 1248–1c–1b.

17369. *Red Maure* selection. Grown from Agrost. No. 1479–1a–1.

17370. *Brown Crowder.* Grown from Agrost. No. 1490–2.

17371. *Small Whippoorwill Crowder.* Grown from Agrost. No. 1490½–2.

17372. *Wight Black Crowder.* Grown from Agrost. No. 1496–2.

17373. *Delicious Large Lady.* Grown from Agrost. No. 1486–2.

17374. *Red Whippoorwill.* Grown from Agrost. No. 1596–1.

17375. *Jhunga,* large white. Grown from Agrost. No. 1620–1G.

17376. *Chauli,* white. Grown from Agrost. No. 1632–1.

17377. *Choli,* small red. Grown from Agrost. No. 1636–1G.

17378. *Bhadela,* red. Grown from Agrost. No. 1629–1.

17379. *Bhadela,* red. Grown from Agrost. No. 1629–1G.

17380. *Barbati,* large red. Grown from Agrost. No. 1625–1G.

17381. *Choli,* small red. Grown from Agrost. No. 1636–1.

FEB 19 1908

17327 to 17436—Continued.

17382. *Barbati*, large red. Grown from Agrost. No. 1625–1.

17383. *Clay*, from *Melear*. Grown from Agrost. No. 17778–1.

17384. Selection from hybrid *Black* × *Iron*. Grown from Agrost. No. 2638.

17385. Selection from hybrid *Black* × *Iron*. Grown from Agrost. No. 2637.

17386. *Sixty-Day*. Grown from Agrost. No. 2649.

17387. *Sixty-Day*. Grown from Agrost. No. 2651.

17388. *Lady-Finger*. Grown from Agrost. No. 2630.

17389. Selection from hybrid *Black* × *Iron*. Grown from Agrost. No. 2639.

17390. *Grayeye*. Grown from Agrost. No. 2631.

17391. Selection from *Clay*. Grown from Agrost. No. 2634.

17392. *Powell's Early Prolific*. Grown from Agrost. No. 2643.

17393. *Red Crowder*. Grown from Agrost. No. 2642.

17394. *Yellow Sugar Crowder*. Grown from Agrost. No. 2645.

17395. Selection from *Clay*. Grown from Agrost. No. 2633.

17396. Selection from *Iron*. Grown from Agrost. No. 2636.

17397. Selection from *Iron*. Grown from Agrost. No. 2635.

17398. *Browneye Crowder*. Grown from Agrost. No. 2641.

17399. *Whittle*. Grown from Agrost. No. 2644.

17400. Selection from second hybrid *Brown* × *Iron*. Grown from Agrost. No. 2640.

17401. *Rice, Long Lady*. Grown from Agrost. No. 1954–1.

17402. *Michigan Favorite*. Grown from Agrost. No. 1991–1.

17403. *New Era*. Grown from Agrost. No. 1936–1.

17404. *Brown Coffee*. Grown from Agrost. No. 1985–1G.

17405. Pinkish tan selection from *Steckler's Improved*. Grown from Agrost. No. 1935–c.

17406. *Michigan Favorite*. Grown from Agrost. No. 1991.

17407. *Steckler's Improved*. Grown from Agrost. No. 1935–1G.

17408. *Whippoorwill* × *Lady*. Grown from Agrost. No. 2027–1.

17409. *Whippoorwill Saddleback*. Grown from Agrost. No. 2025–1.

17410. *Black* × *Blackeye*. Grown from Agrost. No. 2021–1.

17411. Selection from *New Era*. Grown from Agrost. No. 2020–1.

17412. *Speckled Java*. Grown from Agrost. No. 2009–1.

17413. *Calico*. Grown from Agrost. No. 2005–1.

17414. *Coffee*. Grown from Agrost. No. 2008–1.

17415. *Conch*. Grown from Agrost. No. 2013–1.

17416. *Red Whippoorwill*. Grown from Agrost. No. 2003–1.

17417. *Extra Early Blackeye* × *Black*. Grown from Agrost. No. 2018–1.

17418. *Holstein*. Grown from Agrost. No. 2014–1.

17419. *Little Iron*. Grown from Agrost. No. 2006–1.

17420. *Black-Eyed Lady*. Grown from Agrost. No. 2004–1.

17421. Grown from Agrost. No. 2023–1 from the Arkansas Experiment Station.

17422. *Warren's Extra Early* × *Sugar Crowder*. Grown from Agrost. No. 2022–1.

17327 to 17436—Continued.

17423. *Iron Mountain.* Grown from Agrost. No. 2017-1.

17424. *Extra Early Blackeye* × *Black.* Grown from Agrost. No. 2019-1.

17425. *Watson's Hybrid.* Grown from Agrost. No. 2007-1.

17426. *Mount Olive.* Grown from Agrost. No. 2011-1.

17427. *Sport.* Grown from Agrost. No. 2024-1.

17428. *Red Crowder.* Grown from Agrost. No. 2012-1.

17429. Grown from Agrost. No. 2029-1 from the Arkansas Experiment Station.

17430. *Iron.* Grown from Agrost. No. 2136.

17431. *Iron.* Grown from Agrost. No. 2310.

17432. *Michigan Favorite.* Grown from Agrost. No. 2309.

17433. *Iron.* Grown from Agrost. No. 2217.

17434. *Iron.* Grown from Agrost. No. 2386.

17435. *Iron.* Grown from Agrost. No. 2260.

17436. *Iron.* Grown from Agrost. No. 2387.

17437. AGAVE RIGIDA SISALANA. **Sisal.**

From Santiago de las Vegas and Havana, Cuba. Received at the Porto Rico Agricultural Experiment Station, Mayaguez, P. R., May 8, 1906.

"Suckers and rooted bulbils collected from plants growing without cultivation in the vicinity of Havana and Santiago de las Vegas." (*Dewey.*)

17438 to 17448.

From Floral Park, Long Island, N. Y. Received through Mr. John Lewis Childs, February 2, 1906.

17438.	STREPTOSOLEN AMABILIS MAGNIFICA.	
17439.	RICHARDIA FRAGRANS.	**Calla.**
17440.	RICHARDIA CHILDSIANA.	**Calla.**
17441.	RICHARDIA AFRICANA NANA COMPACTA.	**Little gem calla.**
17442.	RICHARDIA PRAECOX.	**Calla.**
17443.	RICHARDIA AETHIOPICA GIGANTEA.	**Calla.**
17444.	RICHARDIA ELLIOTTIANA.	**Golden calla.**
17445.	RICHARDIA ALBO-MACULATA.	**Spotted calla.**
17446.	RICHARDIA HASTATA.	**Yellow calla.**
17447.	RICHARDIA AURATA.	**Calla.**
17448.	RICHARDIA RHEMANNI.	**Rose calla.**

17449. MEDICAGO SATIVA. **Alfalfa.**

From Chicago, Ill. Received through the A. Dickinson Company, January 30, 1906.

Utah-grown alfalfa seed.

17450. AVENA SATIVA. **Oat.**

From Richmond, Va. Received through T. W. Wood & Sons, February 1, 1906.

Fall-sown *Appler Rustproof.*

17451. AVENA SATIVA. **Oat.**

From Richmond, Va. Received through T. W. Wood & Sons, January 27, 1906.

Burt.

17452. AVENA SATIVA. **Oat.**

From Augusta, Ga. Received through the N. L. Willet Seed Company, February 1, 1906.

Fall-sown *Appler Rustproof.*

17453 to 17461. XANTHOSOMA spp. **Yautia.**

From Ceylon. Presented by Mr. H. F. Macmillan. Received February 2, 1906.

Roots as follows:

17453. *Kalu Ala.*
17454. *Malanga Blanca.*
17455. *Dehi Ala.*
17456. *Nianie Islenio.*
17457. *Kaudala.*
17458. *Malanga Amarillo.*
17459. *Garendi Kaudala.*
17460. *Desa Ala.*
17461. *Kelu Kaudala.*

17462 and 17463. XANTHOSOMA spp. **Yautia.**

From Cocoanut Grove, Fla. Received through Mr. O. W. Barrett, February 5, 1906.

Honduras varieties.

17464. AVENA SATIVA. **Oat.**

From Yancey, Ga. Received through Mr. H. Yancey, jr., September 28, 1904.

Pure *Appler Rustproof* oats to be planted for the purpose of growing pure stock seed. Hand selected from S. P. I. No. 11722, February, 1906.

17465. NICOTIANA TABACUM. **Tobacco.**

From Portici, Naples, Italy. Presented by Prof. O. Comes. Received May 16, 1906.

Latakia.

17466 to 17470.

From North China. Received through Mr. F. N. Meyer, February 6, 1906.

Plants and cuttings, as follows:

17466. CAREX STENOPHYLLA. **Sedge.**

From Marble Pagoda grounds, Peking. "(Nos. 70b and 70c.) A most wonderful 'grass' for lawns. It will save a tremendous lot of drudgery if we can establish this in the United States, for, according to the gardener of the German legation grounds, it is the only 'grass' in dry North China that keeps green all summer notwithstanding droughts. It grows on the rockiest and poorest of soils and never needs mowing. I consider it of the utmost importance, especially for those regions of the United States where there is but a slight amount of precipitation." (*Meyer.*)

17467. VITIS sp. **Grape.**

From Tientsin. "(Nos. 59, 60, and 61.) A pale purple grape ripening in early September; produces large bunches and is a heavy bearer. Taste of the berries a trifle watery, but otherwise a good grape. Can be kept in cold storage for a whole year. The vines are buried during the winter months." (*Meyer.*)

17466 to 17470—Continued.

17468. Vitis sp. **Grape.**

From Tientsin. "(Nos. 62, 63, 64. and 65.) A dark purple grape, with somewhat smaller berries than No. 59 (S. P. I. No. 17467); otherwise the same description applies to it." (*Meyer.*)

17469. Rosa sp. **Rose.**

From Peking. "(Nos. 67 and 68.) A semidouble, yellow rose frequently met in the gardens here. Is a very thrifty grower and able to withstand long droughts. The straight young shoots grow from 5 to 8 feet in height." (*Meyer.*)

17470. Amygdalus persica. **Peach.**

From Peking. "(No. 69.) Bud sticks from the tree in the grounds of the German legation in Peking, from which one bag of seeds was sent under No. 9a (S. P. I. No. 18262)." (*Meyer.*)

17471. Triticum durum. **Macaroni wheat.**

From Littleton, Colo. Received through Mr. James B. Mills, February 7, 1906.

Kubanka.

17472. Crataegus sp. **Hawthorn.**

From Shanghai, China. Presented by Rev. J. M. W. Farnham, D. D., of the Chinese Tract Society. Received February 8, 1906.

17473. Rubus sp. **Himalaya blackberry.**

From Albany, Oreg. Received through Mr. Albert Brownlow, February, 1906.

Himalaya (synonym, *Himalaya Giant*) blackberry. "This blackberry was grown by Mr. Luther Burbank from seeds received by him about 1889 or 1890 from a friend, who stated that they had been gathered high up on the Himalaya Mountains. It was sparingly disseminated by Mr. Burbank on the Pacific coast about 1894. It is reported to be a very vigorous, semitrailing variety, somewhat closely resembling the 'Evergreen' blackberry of Oregon, but, unlike that sort, shedding its leaves in autumn. In western Washington and Oregon it has been found entirely hardy and in most soils yields very large crops of fruit of good size and quality, ripening earlier than the 'Evergreen.' Although not strictly a trailer, its recumbent habit and very strong growth render a trellis advisable in its culture.

"It is distributed at this time with a view to determining its relative hardiness and its adaptability to culture in sections east of the Rocky Mountains." (*Taylor.*)

17474. Pistacia vera. **Pistache.**

From Khost, India. Presented by Mr. Philip Parker, of the Indian Irrigation Service, through J. S. Davis, esq., executive engineer, Bannu, Karum Valley Irrigation Project. Received through Mr. W. T. Swingle, May 21, 1906.

"An unusually interesting deep green variety of the wild nut." (*Swingle.*)

17475. Andropogon sorghum. **Kafir corn.**

From Lawrence, Kans. Received through F. Barteldes & Co., April 3, 1906.

17476. Medicago sativa. **Alfalfa.**

From Brady, Nebr.

Seed from a single plant. Selected by J. M. Westgate, of this Department, September 28, 1905, in a field belonging to H. K. Peckham, on account of size, drought resistance, hardiness, white flowers, and seeding qualities.

17477. PHYSALIS FRANCHETI. **Ground cherry.**

From Samarkand, Turkestan. Received through Mr. Frank Benton, February 9, 1906.

"(No. 25.) Similar to, if not identical with, No. 18 (S. P. I. 15931) from Caucasus. Pods same color, bright crimson, but longer and more pointed. Fruit seems better in quality and is sold in native bazaars. No. 18 is also eaten sometimes, but is more acrid than No. 25." (*Benton.*)

17478. CUCUMIS MELO. **Winter muskmelon.**

From Erivan, southern Caucasus, Russia. Received through Mr. Frank Benton, January 26, 1906.

"(No. 20.) Locally known as *Dutma.* Medium-sized yellow melon with light green flesh. Good quality. Keeps into the winter if hung up in a cool room. A gardener in Erivan states that it is their practice to cover the fruits, when partly grown, with earth, which is left until autumn." (*Benton.*)

17479. ELAEAGNUS sp. **Oleaster.**

From Wagarschapat, southern Caucasus, Russia. Received through Mr. Frank Benton, January 26, 1906.

"(No. 21.) Seeds of an edible fruit known in Armenian as '*Pschad,*' which grows on a good-sized tree. The flesh of the fruit is dry and mealy, tastes something like that of a banana, but is more acid. Much sought after by children. Probably an Elaeagnus. Collected in October, 1905." (*Benton.*)

17480. CUCUMIS MELO. **Winter muskmelon.**

From Old Samarkand, Turkestan. Received through Mr. Frank Benton, January 22, 1906.

"(No. 22.) Seed of a winter muskmelon purchased in Sart Bazaar at Old Samarkand, Turkestan, in December, 1905. Rather small, oval, yellow melon with dark bronze shading. Flesh light green or yellowish-green. Quality medium. Keeps until midwinter if hung up in a cool room. Ripens when brought into a warm room." (*Benton.*)

17481. CUCUMIS MELO. **Winter muskmelon.**

From Samarkand, Turkestan. Received through Mr. Frank Benton, January 26, 1906.

"(No. 23.) Seed of a winter muskmelon purchased in Samarkand in December, 1905. Large, oblong, yellow melon, with thick, light green flesh, fair quality; weight about 10 pounds. Keeps until midwinter if hung in a cool room. Some bronze shading on outside; may be only a large specimen of No. 22 (S. P. I. No. 17480)." (*Benton.*)

17482. CUCUMIS MELO. **Winter muskmelon.**

From Samarkand, Turkestan. Received through Mr. Frank Benton, January 26, 1906.

"(No. 24.) Rather large, slightly oval in form, yellow outside with heavy bronze shading; flesh light green, good quality. May be only a better specimen of Nos. 22 and 23 (S. P. I. Nos. 17480 and 17481)." (*Benton.*)

17483 to 17487.

From Hamilton, Canada. Received through John A. Bruce & Co., February 12, 1906.

17483. PISUM ARVENSE. **Field pea.**

Golden Vine.

17484. LATHYRUS SATIVUS. **Bitter vetch.**

Grass Pea.

17483 to 17487—Continued.

17485. PISUM ARVENSE. **Field pea.**

White Marrowfat.

17486. PISUM ARVENSE. **Field pea.**

Blackeye Marrowfat.

17487. PISUM ARVENSE. **Field pea.**

Blue Prussian.

17488. PHALARIS CANARIENSIS. **Canary grass.**

From San Jose, Cal. Received through Braslan Seed Growers' Company, February 10, 1906.

17489. AGROPYRON TENERUM. **Slender wheat-grass.**

From Brandon, Manitoba. Received through A. E. McKenzie & Co., February 10, 1906.

17490. ANDROPOGON SORGHUM. **Sorghum.**

From Tyro, Kans. Received through Mr. G. R. Wheeler, February 12, 1906.

Simmon's Cane.

17491. MELILOTUS ALBA. **Sweet clover.**

From Beloit, Wis. Received through Mr. I. M. Buell, February 12, 1906.

17492 and 17493. VIGNA UNGUICULATA. **Cowpea.**

From Arlington Farm, Virginia. Crop of 1905.

17492. Grown from Abyssinian seed, S. P. I. No. 11074.

17493. Grown from Abyssinian seed, S. P. I. No. 11091.

17494 and 17495.

From Auckland, New Zealand. Received through the Auckland Department of Agriculture, February 12, 1906.

17494. DANTHONIA SEMIANNULARIS. **Wallaby grass.**

17495. MICROLAENA STIPOIDES. **New Zealand meadow rice-grass.**

17496 and 17497.

From Lausanne, Switzerland. Presented by Prof. G. Martinet, director, Établissement Fédéral d'Essais et de Controle de Semences à Lausanne, February 12, 1906.

17496. VICIA GLABRESCENS. **Vetch.**

17497. LATHYRUS HETEROPHYLLUS.

17498. KICKXIA ELASTICA.

From Victoria, Kamerun, German West Africa. Received through the Victoria Agricultural Experiment Station, January 26, 1906.

17499 to 17504. NICOTIANA spp. **Tobacco.**

From Portici, Italy. Presented by Prof. O. Comes. Received February 9, 1906.

"A collection of varieties of tobacco forming part of the extensive collection made by Professor Comes, author of various works on tobacco, and especially the work enti-

17499 to 17504—Continued.

tled 'The Races of Tobacco.' Imported for breeding experiments in connection with a search for a disease-resistant strain in North Carolina." (*Fairchild.*)

17499. NICOTIANA TABACUM FRUTICOSA.

Karchiaku.

17500. NICOTIANA TABACUM FRUTICOSA.

Doniaku.

17501. NICOTIANA ALATA PERSICA.

Schiraz.

17502. NICOTIANA RUSTICA TEXANA.

Calcutta.

17503. NICOTIANA RUSTICA BRASILIA.

Dzjouchin Rhau.

17504. NICOTIANA RUSTICA BRASILIA.

Veilchen.

17505 and 17506. CITRUS AURANTIUM. **Orange.**

From Shanghai, China. Presented by Rev. J. M. W. Farnham, D. D. Received February 8, 1906.

Orange seeds, as follows:

17505. From Swatow, China. "A very fine loose-skinned variety; lobes separate easily." (*Farnham.*)

17506. From Canton, China. "A better variety of orange than I have ever eaten in the United States or Europe. Close skin, and lobes not separable." (*Farnham.*)

17507. CITRUS AURANTIUM. **Orange.**

From Algiers, Algeria. Presented by Dr. L. Trabut, government botanist. Received February 8, 1906.

"Seeds of the famous orange *Blida*, which, according to Doctor Trabut's label, is an early variety, having large, sweet fruits and reproducing by seeds. The *Blida* orange is one of the best grown in northern Algeria and, as I understand, these seeds are from selected fruits of this variety." (*Swingle.*)

17508. TRIFOLIUM PRATENSE. **Red clover.**

From Lausanne, Switzerland. Presented by Prof. G. Martinet, director, Etablissement Federal D'Essais et de Controle de Semences a Lausanne. Received February 12, 1906.

Selection with yellow grains.

17509. BETA VULGARIS. **Sugar beet.**

From Fairfield, Wash. Received through Mr. E. H. Morrison. Crop of 1905.

Kleinwanzleben.

17510. QUERCUS CUSPIDATA.

From Yokohama, Japan. Received through Mr. F. N. Meyer from the Yokohama Nursery Company, February 15, 1906.

This is an evergreen oak much used in Japan for hedges, for which it seems admirably suited. Its acorns, although of small size, are of very sweet taste when baked like chestnuts, and when boiled or roasted are regularly sold in Japan for food; not hardy in the northern States.

17511. SECHIUM EDULE. **Chayoté.**

From Biloxi, Miss. Presented by Mr. Aristide Hopkins. Received February 15, 1906.

Fruits of a green variety.

17512. PHASEOLUS RADIATUS. **Mung bean.**

From De Quincy, La. Received through Dr. S. A. Knapp, February 16, 1906.

Grown from S. P. I. No. 10527.

17513. ANDROPOGON SORGHUM. **Milo.**

From Memphis, Tenn. Received through Mr. J. E. Bradley, February 16, 1906.

Dwarf.

17514 and 17515.

From Buitenzorg, Java. Presented by Dr. M. Treub, director of the Botanical Gardens. Received February 16, 1906.

Seeds, as follows:

17514. GARCINIA MANGOSTANA. **Mangosteen.**

17515. NEPHELIUM LAPPACEUM. **Rambutan.**

Native of south India and Malay islands and furnishes a fruit similar to the Litchi, namely, the *Rambutan* or *Ramboostan* fruit. All species of Nephelium seem to require rather a moist, mild, forest clime than great atmospheric heat. The fruit is of a bright red color, about 2 inches long, of an oval form, and slightly flattened, and covered with long, soft, fleshy spines or thick hair. Like the other Nepheliums it contains a pleasant acidulous pulp, very grateful in tropical countries.

17516. ZEA MAYS. **Corn.**

From St. Anthony Park, St. Paul, Minn. Received through the Minnesota Agricultural Experiment Station, February, 1906.

Crosby. Grown in 1905 from S. P. I. No. 13570; selected to ears of plump form with 14 rows and over.

17517. ZEA MAYS. **Corn.**

From Simsbury, Conn. Received through Mr. A. R. Dayton, February, 1906.

Crosby. Grown in 1905 from S. P. I. No. 13570; selected from two-eared stalks.

17518. ZEA MAYS. **Corn.**

From Simsbury, Conn. Received through Mr. A. R. Dayton, February, 1906.

Crosby. Grown in 1905 from S. P. I. No. 13570; selected from compact plants with ears low on stalk.

17519. VIGNA UNGUICULATA. **Cowpea.**

From Richmond, Va. Received through T. W. Wood & Sons, February 16, 1906.

Red Carolina. "One of the surest cropping of cowpeas, yielding well in both wet and dry seasons. The vines are not as long as *Black* and *Red Ripper*, but are thicker and bunchier, completely covering the ground, and can be more easily cut and cured. Does well on nearly all classes of soils, and better than any other sort on stiff clay soils. The long pods contain 18 to 20 peas, and are easier and less expensive to pick than the short-podded sorts. We recommend it strongly, believing that our growers will find in it distinct advantages over other kinds." (*Wood & Sons.*)

17520. GLYCINE HISPIDA. **Soy bean.**

From Richmond, Va. Received through T. W. Wood & Sons, February 16, 1906.

Hollybrook Early. "A particularly valuable strain of soy beans, which matures its crop three weeks earlier than the *Mammoth Yellow* soy, and is consequently better adapted for planting in sections north of Virginia, or for planting late in order to make a crop of shelled beans. The yield from the *Hollybrook Early* soy is very nearly equal to that of the *Mammoth Yellow,* and they are sure to make a crop of beans. The *Mammoth Yellow* soy requires the full growing season to mature its crop, and frequently an early frost will cut short the yield of the crop of beans. There is no such danger with *Hollybrook Early* soys, and they will prove to be a distinct and valuable acquisition." (*Wood & Sons.*)

17521. PASSIFLORA QUADRANGULARIS. **Granadilla.**

From Juarez, Chihuahua, Mexico. Presented by Mr. Elmer Stearns. Received February 15, 1906.

17522. CUCUMIS MELO. **Winter muskmelon.**

From Ispahan, Persia. Received through Mr. Frank Benton, February 14, 1906.

"Bears transportation long distances over bad roads; good quality, very juicy, fairly sweet. Long, oval, light yellow or straw colored outside with rather fine brown netting. Rind thin; flesh light straw colored, with a watery or semitransparent appearance. Ispahan is on a great plateau, 5,400 feet above sea level." (*Benton.*)

17523 and 17524.

From Bagdad, Turkey. Presented by Hon. Rudolph Hurner, United States vice-consul. Received February 8, 1906.

17523. ZEA MAYS. **Corn.**

"*Edreh Scham*" (*Damascus Edreh*). Small, yellow flint corn.

17524. ANDROPOGON SORGHUM. **Sorghum.**

"*Edreh Trak*" (or *Irak*).

17525 to 17527.

From Geneva, Idaho. Received through Mr. F. W. Boehme, February, 1906.

17525. HORDEUM VULGARE. **Barley.**

Beardless.

17526. AVENA SATIVA. **Oat.**

Swedish Select.

17527. AVENA SATIVA. **Oat.**

Sixty-Day.

17528 and 17529.

From Niu-chwang, China. Received from the Chinese magistrate of the Haicheng district, through Mr. Thomas Sammons, United States consul-general at Niu-chwang, February 12, 1906.

17528. CANNABIS SATIVA. **Hemp.**

"Manchurian fine thread hemp seed." (*Sammons.*)

17529. ABUTILON AVICENNAE. **China jute.**

"Manchurian coarse rope hemp seed." (*Sammons.*)

17530 to 17533. Arachis hypogaea. **Peanut.**

From Mikindani, German East Africa. Presented by Prof. Dr. A. Zimmermann, Biologisch Landwirtschaftliches Institut, Amani, German East Africa. Received February 16, 1906.

No varietal names received.

17534. Dolichos atropurpureus.

From Waterloo, Kans. Received through Mr. J. W. Riggs, February 10, 1906.

17535 to 17537. Andropogon sorghum. **Sorghum.**

From Lyallpur, India. Received through Mr. Theodore C. Maller, of Amritsar, India, February 16, 1906.

Sorghum seed, as follows:

17535. *White Juar of Lyallpur.*

17536. *Sweet Juar of Lyallpur.*

17537. *Red Juar of Lyallpur.*

17538 to 17687. Andropogon sorghum. **Sorghum.**

From Chillicothe, Tex.

A collection of sorghums grown in 1905 on the Department's experimental farm at Chillicothe, as follows:

17538. *Planter's Friend.* Grown from Agrost. No. 1697, from New South Wales, Australia.

17539. *Planter's Friend.* Grown from Agrost. No. 2119, from Queensland, Australia.

17540. "*S. saccharatum.*" Grown from Agrost. No. 1605, from Sydney, Australia.

17541. *Black-Seeded.* Grown from Agrost. No. 1656, from New South Wales, Australia.

17542. *Black-Seeded.* Grown from Agrost. No. 1694, from New South Wales, Australia.

17543. *Amber.* Grown from Agrost. No. 1695, from New South Wales, Australia.

17544. *Dwarf Amber.* Grown from Agrost. No. 2118, from Queensland, Australia.

17545. *Undendibule.* Grown from Agrost. No. 1752, from Victoria, Australia; first selection.

17546. *Undendibule.* Grown from Agrost. No. 1752, from Victoria, Australia; second selection.

17547. *Orange.* Grown from Agrost. No. 1661, from New South Wales, Australia.

17548. *Orange.* Grown from Agrost. No. 1696, from New South Wales, Australia.

17549. *Orange.* Grown from Agrost. No. 2095, from Congressional seed distribution; first selection.

17550. *Orange.* Grown from Agrost. No. 2095; second selection.

17551. *Orange.* Grown from Agrost. No. 2125, from Queensland, Australia; first selection.

17552. *Orange.* Grown from Agrost. No. 2125; second selection.

17553. *Texas Gooseneck* (*Texas Seeded "Ribbon Cane"*). Grown from Agrost. No. 1812, from the Texas Seed and Floral Company, Dallas, Tex.

17538 to 17687—Continued.

17554. *Sumac.* Grown from Agrost. No. 1946, from the Tennessee Experiment Station.

17555. *Folger's Early.* Grown from Agrost. No. 2120, from Queensland, Australia.

17556. *Colman.* Grown from Agrost. No. 2121, from Queensland, Australia.

17557. *Collier.* Grown from Agrost. No. 2124, from Queensland, Australia; first selection.

17558. *Collier.* Grown from Agrost. No. 2124; second selection.

17559. *Russian Sugar.* Grown from Agrost. No. 1581, from Russia.

17560. *Austrian Sugar.* Grown from Agrost. No. 1607, from Vienna.

17561. *Black Sorghum.* Grown from Agrost. No. 1811, from Barbados, West Indies.

17562. *Yellow Milo.* Grown from Agrost. No. 1753, from Victoria, Australia.

17563. *Yellow Milo.* Selected pendent heads grown from Agrost. No. 2522, from Thorburn & Co., New York, N. Y.

17564. *Yellow Milo.* Selected erect heads grown from Agrost. No. 2522.

17565. *Yellow Milo.* Grown from Agrost. No. 2090, from Chillicothe, Tex.

17566. *Red Kafir.* Grown from Agrost. No. 1751, from Victoria, Australia.

17567. *Red Kafir.* Grown from Agrost. No. 2116, from Queensland, Australia.

17568. *Black-Hulled White Kafir.* Grown from Agrost. No. 1749, from Victoria, Australia.

17569. *Black-Hulled White Kafir.* Grown from Agrost. No. 1993, from the Iowa Seed Company, Des Moines, Iowa.

17570. *White Milo.* Grown from Agrost. No. 2115, from Queensland, Australia.

17571. *White-Hulled White Kafir.* Grown from Agrost. No. 2122, from Queensland, Australia.

17572. *Black-Hulled White Kafir.* Grown from Agrost. No. 1754, from Victoria, Australia.

17573. *Dharla* (A). Grown from S. P. I. No. 14500.

17574. *Kalbondi.* Grown from S. P. I. No. 14508.

17575. *Gare Nasik.* Grown from S. P. I. No. 14516.

17576. *Bile Jura.* Grown from S. P. I. No. 14524.

17577. *Meldani.* Grown from S. P. I. No. 14535.

17578. *Kondi.* Grown from S. P. I. No. 14544.

17579. *Nadyal.* Grown from S. P. I. No. 14583.

17580. *Juari.* Grown from S. P. I. No. 14584.

17581. *White Dumraon.* Grown from S. P. I. No. 14585.

17582. *Gumeri.* Grown from S. P. I. No. 14586; first selection.

17583. *Gumeri.* Grown from S. P. I. No. 14586; second selection.

17584. *Dukri.* Grown from S. P. I. No. 14587.

17585. *Durga.* Grown from S. P. I. No. 14588.

17538 to 17687—Continued.

17586. *Bana of Jalaon.* Grown from S. P. I. No. 14589.

17587. *Bhanna of Jhansi.* Grown from S. P. I. No. 14590.

17588. *Lal.* Grown from S. P. I. No. 14591.

17589. *Doliya.* Grown from S. P. I. No. 14593; first selection.

17590. *Doliya.* Grown from S. P. I. No. 14593; second selection.

17591. *Bania.* Grown from S. P. I. No. 14594.

17592. *Laliya.* Grown from S. P. I. No. 14595.

17593. *Kombrai.* Grown from S. P. I. No. 14597.

17594. *Pyaria Iksari Banda.* Grown from S. P. I. No. 14598.

17595. *Iksari Banda.* Grown from S. P. I. No. 14599.

17596. *Pyaria.* Grown from S. P. I. No. 14600.

17597. *Alapuri.* Grown from S. P. I. No. 14602.

17598. *Dulari.* Grown from S. P. I. No. 14603.

17599. *Dugadia Zard.* Grown from S. P. I. No. 14604.

17600. *Ikdani.* Grown from S. P. I. No. 14605.

17601. *Purbi Magha.* Grown from S. P. I. No. 14606.

17602. *Country White.* Grown from S. P. I. No. 14607.

17603. *Dugadia Safed.* Grown from S. P. I. No. 14608; first selection.

17604. *Dugadia Safed.* Grown from S. P. I. No. 14608; second selection.

17605. *Jogia.* Grown from S. P. I. No. 14609.

17606. *Domni.* Grown from S. P. I. No. 14610.

17607. *Chatka.* Grown from S. P. I. No. 14611.

17608. *Bangra.* Grown from S. P. I. No. 14612.

17609. *Lallu.* Grown from S. P. I. No. 14613; first selection.

17610. *Lallu.* Grown from S. P. I. No. 14613; second selection.

17611. *Purbi Murabad.* Grown from S. P. I. No. 14617.

17612. *Deshi.* Grown from S. P. I. No. 14618.

17613. *Ganga Jamni.* Grown from S. P. I. No. 14619.

17614. *Bannia Dadri.* Grown from S. P. I. No. 14622.

17615. *Red of Ajangarh.* Grown from S. P. I. No. 14626; first selection.

17616. *Red of Ajangarh.* Grown from S. P. I. No. 14626; second selection.

17617. *Bannia.* Grown from S. P. I. No. 14627.

17618. *Jhangaria.* Grown from S. P. I. No. 14631.

17619. *Palarhia.* Grown from S. P. I. No. 14634.

17620. *Ganga Jali.* Grown from S. P. I. No. 14641.

17621. *Lohor.* Grown from S. P. I. No. 14647.

17622. *Shalu.* Grown from S. P. I. No. 14666; first selection.

17623. *Shalu.* Grown from S. P. I. No. 14666; second selection.

17624. *Makchandri.* Grown from S. P. I. No. 14667.

17625. *Holgi.* Grown from S. P. I. No. 14668.

17626. *Hundi.* Grown from S. P. I. No. 14669.

17627. *Kagi Moti.* Grown from S. P. I. No. 14671.

17538 to 17687—Continued.

17628. *Kalbondi.* Grown from S. P. I. No. 14673.
17629. *Duhar Maski.* Grown from S. P. I. No. 14674.
17630. *Bendri.* Grown from S. P. I. No. 14675; first selection.
17631. *Bendri.* Grown from S. P. I. No. 14675; second selection.
17632. *Guldhavi.* Grown from S. P. I. No. 14676.
17633. *Lakdi.* Grown from S. P. I. No. 14677.
17634. *Shalu.* Grown from S. P. I. No. 14678.
17635. *Gola.* Grown from S. P. I. No. 14680.
17636. *Khondi Chandor.* Grown from S. P. I. No. 14684; first selection.
17637. *Khondi Chandor.* Grown from S. P. I. No. 14684; second selection.
17638. *Khondi Chandor.* Grown from S. P. I. No. 14684; third selection.
17639. *Dadar.* Grown from S. P. I. No. 14687.
17640. *Khonde Malegaon.* Grown from S. P. I. No. 14688.
17641. *Shalu.* Grown from S. P. I. No. 14689.
17642. *Dagdi.* Grown from S. P. I. No. 14691.
17643. *Shalu.* Grown from S. P. I. No. 14694.
17644. *Hundi.* Grown from S. P. I. No. 14697.
17645. *Waradi Juar.* Grown from S. P. I. No. 14699.
17646. *Hundi.* Grown from S. P. I. No. 14700.
17647. *Jondhala.* Grown from S. P. I. No. 14701; first selection.
17648. *Jondhala.* Grown from S. P. I. No. 14701; second selection
17649. *Maldani.* Grown from S. P. I. No. 14702.
17650. *Tambdi.* Grown from S. P. I. No. 14703.
17651. *Gudadi.* Grown from S. P. I. No. 14704.
17652. *Jagadi.* Grown from S. P. I. No. 14705.
17653. *Dadia.* Grown from S. P. I. No. 14706.
17654. *Fafaria.* Grown from S. P. I. No. 14707.
17655. *Deshi Perio.* Grown from S. P. I. No. 14708.
17656. *Sholapuri.* Grown from S. P. I. No. 14709.
17657. *Ratadia.* Grown from S. P. I. No. 14713; first selection.
17658. *Ratadia.* Grown from S. P. I. No. 14713; second selection.
17659. *Malvan.* Grown from S. P. I. No. 14718.
17660. *Utavli.* Grown from S. P. I. No. 14719.
17661. *Sakar Makar.* Grown from S. P. I. No. 14720.
17662. *Sundhia* (B). Grown from S. P. I. No. 14721.
17663. *Collier.* Grown from S. P. I. No. 14723.
17664. *Raj Hansa.* Grown from S. P. I. No. 14724.
17665. *Imphee.* Grown from S. P. I. No. 14725.
17666. *Motichur.* Grown from S. P. I. No. 14728.
17667. *Rati* (A). Grown from S. P. I. No. 14733.
17668. *Jogadi.* Grown from S. P. I. No. 14734.
17669. *Kempu Poona.* Grown from S. P. I. No. 14742.
17670. *Kempu* (A). Grown from S. P. I. No. 14744.

17538 to 17687—Continued.

17671. *Holgi Gola.* Grown from S. P. I. No. 14749.

17672. *Dudha Mogra.* Grown from S. P. I. No. 14750.

17673. *Tambdi Sholapuri.* Grown from S. P. I. No. 14751.

17674. *Dukri* (B). Grown from S. P. I. No. 14753.

17675. *Holgi Jola.* Grown from S. P. I. No. 14761.

17676. *Chikna.* Grown from S. P. I. No. 14762.

17677. *Maldandi* (A) *Poona.* Grown from S. P. I. No. 14763.

17678. *Kagi.* Grown from S. P. I. No. 14766.

17679. *Darker.* Grown from S. P. I. No. 14767; first selection.

17680. *Darker.* Grown from S. P. I. No. 14767; second selection.

17681. *Darker* (A). Grown from S. P. I. No. 14768.

17682. *Sundhia Juwar* (Poona Farm). Grown from S. P. I. No. 14769.

17683. *Utavli.* Grown from S. P. I. No. 14771.

17684. *Kavli.* Grown from S. P. I. No. 14772.

17685. *Charodi* (Surat Farm). Grown from S. P. I. No. 14773.

17686. *Ameria Sundhia* (Nadiad Farm). Grown from S. P. I. No. 14774.

17687. *Farfaria* (Nadiad Farm). Grown from S. P. I. No. 14775.

17688. ANDROPOGON SORGHUM. **Sorghum.**

From Chillicothe, Tex. Received through Mr. E. J. Randel. Crop of 1905.

Sapling.

17689. ANDROPOGON SORGHUM. **Sorghum.**

From Mecca, Cal. Received through Brauchman Brothers. Crop of 1905.

Durra.

17690. ANDROPOGON SORGHUM. **Sorghum.**

From Mountain View, Okla. Received through Mr. James Cummins. Crop of 1905.

Shallu.

17691. ANDROPOGON SORGHUM. **Giant milo (?).**

From Chillicothe, Tex. Received through Mr. A. B. Conner. Crop of 1905.

Seed of the Giant milo, or possibly a hybrid, collected from plants found growing in several fields.

17692. ZEA MAYS. **Corn.**

From Dallas, Tex. Received through the Texas Seed and Floral Company, February 20, 1906.

Texas Giant Gourd.

17693. VIGNA UNGUICULATA. **Cowpea.**

From Dallas, Tex. Received through the Texas Seed and Floral Company, February 20, 1906.

Cream.

17694. AVENA SATIVA. **Oat.**

From Manhattan, Kans. Received through the Agricultural Experiment Station, February 20, 1906.

Sixty-Day.

17695. ANDROPOGON SORGHUM. **Sorghum.**

From Waterville, Minn. Received through Mr. Seth H. Kenney, February 20, 1906.

Minnesota Early Amber Cane.

17696. PHASEOLUS RADIATUS. **Mung bean.**

From San Jose, Cal. Received through the Braslan Seed Growers Company, February 23, 1906.

17697. VIGNA UNGUICULATA. **Cowpea.**

From Richmond, Va. Received through T. W. Wood & Sons, February 23, 1906.

Iron.

17698. MEDICAGO SATIVA. **Alfalfa.**

From Chinook, Mont. Received through Mr. Thomas O'Hanlon, February 21, 1906.

17699. AGROPYRON OCCIDENTALE. **Western wheat-grass.**

From Harlem, Mont. Received through Mr. Thomas M. Everett, February 21, 1906.

17700 and 17701. AVENA SATIVA. **Oat.**

From Richmond, Va. Received through T. W. Wood & Sons, February 23, 1906.

17700. *Appler Rustproof.* **17701.** *Burt.*

17702. ANDROPOGON SORGHUM. **Sorghum.**

From Richmond, Va. Received through T. W. Wood & Sons, February 23, 1906.

Early Amber Cane.

17703. XANTHOSOMA SAGITTIFOLIUM. **Yautia.**

From Port au Paix, Haiti. Received through Mr. George W. Gulding, February 23, 1906.

17704 to 17707. DIOSPYROS KAKI. **Japanese persimmon.**

From Taiku, Korea. Received through Prof. J. G. Jack, of the Arnold Arboretum, Jamaica Plains, Mass., February 26, 1906.

Cuttings of four varieties of seedless Japanese persimmons.

17708. MUSSAENDA FRONDOSA.

From Manila, P. I. Received through Mr. W. S. Lyon, of the Bureau of Agriculture, February 26, 1906.

"A yellow-flowered, ornamental shrub; flowers subtended by single, large, milk-white calycine leaf; very showy." (*Lyon.*)

17709. ORNITHOPUS SATIVUS. **Serradella.**

From Paris, France. Received through Vilmorin-Andrieux & Co., February 26, 1906.

17710 to 17712. ARACHIS HYPOGAEA. **Peanut.**

From Yokohama, Japan. Received through the Yokohama Nursery Company, February 26, 1906.

Seed of three varieties of peanuts grown in Shimosa Province, as follows:

17710. Small variety.

17711. *Hirata;* the best in Japan; large variety.

17712. *Bachigai* (outsider); large variety.

17713 and 17714. COFFEA ARABICA. **Coffee.**

From Harrar, Abyssinia. Received through the Office of Bionomic Investigations, February 26, 1906.

17713. CULTIVATED COFFEE. **17714.** WILD COFFEE.

17715 and 17716. AGAVE spp. **Century plant.**

From Washington, D. C. Received through Mr. L. H. Dewey, February, 1906.

Plants, as follows:

17715. AGAVE LECHEGUILLA.

From Mexico.

17716. AGAVE RIGIDA SISALANA. **Sisal.**

From the Bahama Islands.

17717. PSOPHOCARPUS TETRAGONOLOBUS. **Seguidillas.**

From Manila, P. I. Presented by Mr. W. S. Lyon, of the Bureau of Agriculture. Received February 26 and April 3, 1906.

"The pods if boiled when exceedingly young and tender taste not unlike asparagus. Vigorous climber, fruiting in three months from the seed and annually from a perennial rootstock in warm climates." (*Lyon.*)

17718 and 17719. VITIS VINIFERA. **Grape.**

From Salonica, Turkey. Received through Rev. J. Henry House, February 15, 1906.

Cuttings, as follows:

17718. *White Kapadjulari.* **17719.** *Black Kapadjulari.*

17720. AVENA SATIVA. **Oat.**

From Aberdeen, S. Dak. Received through Mr. Isaac Lincoln, February 28, 1906.

Sixty-Day.

17721. PAPPOPHORUM NIGRICANS.

From Victoria, Australia. Presented by Prof. Hugh Pye, of the Dookie Agricultural College. Received February 21, 1906.

17722. PHASEOLUS RADIATUS. **Mung bean.**

From Terrell, Tex. Received through W. C. Porter & Co., February 28, 1906.

Probably grown from No. 10527.

17723 to 17743.

From China. Received through Mr. F. N. Meyer, March 1, 1906.

A collection of bud sticks, as follows:

17723. Pyrus sinensis. **Pear.**

From Matou. "(No. 75.) A fine variety of a melting pear called *Pai li.* This form looks to be different from those sent under Nos. 109 and 120 (S. P. I. No. 16911)." (*Meyer.*)

17724. Pyrus sinensis. **Pear.**

From Matou. "(No. 73.) A large variety of the best pear of North China, the so-called Peking pear; in Chinese, *Ya kwam le.* Looks and smells like a quince, but is juicy, melting, and aromatic. May prove to be exceedingly valuable for breeding purposes. The trees grow far more spread out than pears generally do, so they must not be planted too close." (*Meyer.*)

17725. Pyrus sinensis. **Pear.**

From Matou. "(No. 74.) A small variety of the best pear of North China. The same description as for No. 73 serves this one, only it is a far smaller variety and, as such, does not appear on the tables of the best hotels in China." (*Meyer.*)

17726. Pyrus sinensis. **Pear.**

From Matou. "(No. 76.) A large variety of a juicy pear with nonmelting flesh. A very good keeper of fine appearance; somewhat like our *Kieffer* pear. May be most excellent for canning purposes." (*Meyer.*)

17727. Pyrus sp. **Pear.**

From Tsing-ho-pu. "(No. 125.) A wild pear bearing fruits not larger than a hollyberry. Makes an extraordinarily dense head of branches and may be of use in small parks where small shade trees are wanted." (*Meyer.*)

17728. Amygdalus persica. **Peach.**

From Matou. "(No. 82.) A peach described to me by the natives as very large, red meated, and juicy. The trees are thrifty growers." (*Meyer.*)

17729. Amygdalus davidiana.

From the mountains near Tang-shan, near Peking. "(No. 126.) A variety of thrifty growth, with medium-sized buds. Fruits absolutely inedible, but may prove to be very valuable as a spring flowering shrub. The Chinese cultivate many different varieties as dwarfed specimens and for winter forcing." (*Meyer.*)

17730. Amygdalus davidiana.

From the mountains near Tang-shan, near Peking. "(No. 127.) A variety of rather stunted growth, with large-sized buds. May prove to be a valuable addition to our spring flowering shrubs." (*Meyer.*)

17731. Amygdalus davidiana.

From the mountains near Tang-shan, near Peking. "(No. 129.) A very diminutive form of wild peach. Grows in very rocky places and has small, silvery-white twigs. May be of use as a shrub for rockeries." (*Meyer.*)

17732. Prunus sp. **Cherry.**

From Pee-san. "(No. 79.) A bush cherry bearing small, red fruits which ripen here in early June. Is grafted upon wild peach stock low down in the ground." (*Meyer.*)

17733. Prunus sp. **Cherry.**

From Pee-san. "(No. 80.) A larger variety than No. 79; otherwise the the same description applies to it." (*Meyer.*)

17723 to 17743—Continued.

17734. PISTACIA CHINENSIS. **Pistache.**

From Wei-tsan Mountains. "(Nos. 71 and 90.) The staminate form of the Chinese pistache. A very ornamental tree with graceful, pinnate foliage; grows to very large dimensions." (*Meyer.*)

17735. PISTACIA CHINENSIS. **Pistache.**

From Wei-tsan Mountains. "(Nos. 72 and 89.) The carpellate form of the Chinese pistache. A rather ornamental, small tree; bears heavy bunches of small, scarlet, and purplish colored berries." (*Meyer.*)

17736. AESCULUS CHINENSIS. **Chinese horse-chestnut.**

From Wei-tsan Mountains. "(No. 81.) An ornamental shade tree with somewhat smaller leaves than the ordinary horse-chestnut; when old gets to be very spreading. A very rare tree in north China and entirely new to America." (*Meyer.*)

17737. SALIX sp. **Willow.**

From Scha-ho-schonn. "(Nos. 121 and 122.) A remarkable willow which forms naturally a dense, flat-globular head." (*Meyer.*)

17738. SALIX sp. **Willow.**

From the mountains near Tang-shan, near Peking. "(No. 133.) A willow with bright yellow bark, found in a ravine." (*Meyer.*)

17739. CRATAEGUS PINNATIFIDA. **Hawthorn.**

From Matou. "(No. 131.) A variety differing in growth from those sent under No. 9 (S. P. I. No. 17171.) According to the natives, the fruits are of large size. Grown as an ornamental as well as a fruit tree." (*Meyer.*)

17740. CATALPA BUNGEI. **Catalpa.**

From Fung-tai. "(No. 138.) Probably a different form of this beautiful tree from those sent under No. 13 (S. P. I. No. 16914)." (*Meyer.*)

17741. MALUS sp. **Crab apple.**

From Fung-tai. "(No. 139.) An ornamental, red-flowered shrub, common in Chinese gardens. Probably adapted to dry places." (*Meyer.*)

17742. POPULUS sp. **Poplar.**

From Matou. "(No. 77.) A poplar with small leaves and black-colored bark; grown as a wind-break on very sandy soils." (*Meyer.*)

17743. POPULUS sp. **Poplar.**

From Matou. "(No. 132.) A silvery-barked poplar; grown as a wind-break on very sandy soils." (Meyer).

17744 to 17755.

From Chi-li Province, China. Received at the Plant Introduction Garden, Chico, Cal., through Mr. F. N. Meyer, January 23, 1906.

A miscellaneous collection of roots and bud sticks, as follows:

17744. RUBUS sp.

From Shan-hai-kwan. "(No. 6.) A Rubus found in a semishady, dry situation. At the time of collection no fruits were present." (*Meyer.*)

17745. JUGLANS REGIA. **Persian walnut.**

From Chang-li. "(No. 8.) Scions from a soft-shell walnut tree, which produces, according to the owner, on some branches also paper-shell nuts. Nuts sent to Washington, D. C., under 51a (S. P. I. No. 17945)." (*Meyer.*)

17744 to 17755—Continued.

17746. JUGLANS REGIA. **Persian walnut.**

From Chang-li. "(No. 45.) A paper-shell walnut, of which nuts were sent to Washington, D. C., under No. 36a (S. P. I. No. 17946)." (*Meyer.*)

17747. JUGLANS REGIA. **Persian walnut.**

From Chang-li. "(No. 48.) A large nut with medium soft shell." (*Meyer.*)

17748. FRAXINUS LONGICUSPIS (?). **Ash.**

From Shan-hai-kwan. "(Nos. 11 and 19.) An ash which assumed fine, reddish brown tints at the time of collecting. The leaves are not as large or as pinnate as those of *Fraxinus excelsior.* The tree is decidedly ornamental." (*Meyer.*)

17749. (Undetermined.)

From Shan-hai-kwan. "(No. 41.) A shrubby Lespedeza, growing between rocks." (*Meyer.*)

17750. (Undetermined.)

From Shan-hai-kwan. "(No. 43.) A perennial leguminous plant with trifoliate leaves and climbing, semiwoody stems, which are extremely tenacious and are used by the Chinese in tying grapes to trellises and in upholding heavily loaded branches of fruit trees. Is the same as No. 110 (S. P. I. No. 17162)." (*Meyer.*)

17751. CRATAEGUS sp. **Hawthorn.**

From Chang-li. "(No. 42.) The same as No. 10 (S. P. I. No. 17170); used as stock for *Crataegus pinnatifida.*" (*Meyer.*)

17752. ZIZYPHUS SATIVA. **Jujube.**

From Chang-li. "(No. 44.) A large variety of the Chinese 'date'; is grown in large orchards by the Chinese and is used either fresh or dried. The trees are planted from 5 to 10 feet apart, and the bark is ringed to make them bear more heavily." (*Meyer.*)

17753. PINUS sp. **Pine.**

From Chang-li. "(No. 57.) Found growing wild in the mountains; is rather stunted when older, but looks extremely characteristic. Used by the natives to plant in graveyards." (*Meyer.*)

17754. DAUCUS CAROTA. **Carrot.**

From Chang-li. "(No. 58.) A blood red carrot; a very sweet variety used cooked and pickled." (*Meyer.*)

17755. VITIS sp. **Grape.**

From Tientsin. "(No. 66.) A light purple grape with rather small berries; otherwise the same description applies to it as to those sent under Nos. 59 and 65 (S. P. I. Nos. 17467 and 17468)." (*Meyer.*)

17756 and 17757. ANDROPOGON SORGHUM. **Sorghum.**

From Lawrence, Kans. Received through F. Barteldes & Co., March 2, 1906.

17756. *Colman Orange Cane.* **17757.** *African.*

17758 to 17832.

From Glasnevin, Dublin, Ireland. Received from the Royal Botanic Gardens, March 2, 1906.

A collection, mostly of grass and leguminous forage plants seeds, as follows:

17758. Erodium absinthoides.
17759. Erodium cheilanthifolium.
17760. Erodium chelidonifolium.
17760a. Erodium gruinum.
17761. Erodium hymenodes.
17762. Erodium manescavi.
17763. Erodium pelargoniflorum.
17764. Erodium semenovii.
17765. Erodium trichomanifolium.
17766. Erodium verbenaefolium.
17767. Galega biloba.
17768. Galega persica.
17769. Lathyrus armitageanus.
17770. Lathyrus cruikshankii.
17771. Lathyrus gorgoni.
17772. Lathyrus latifolius.
17773. Lathyrus nissolia.
17774. Lathyrus odoratus.
17775. Lathyrus pyrenaicus.
17776. Lathyrus rotundifolius.
17777. Lathyrus sibthorpii.
17778. Medicago decandollii.
17779. Medicago elegans.
17780. Medicago intertexta.
17781. Medicago orbicularis.
17782. Medicago scutellata.
17783. Medicago tuberculata.
17784. Melilotus leucantha.
17785. Onobrychis caput-galli.
17786. Onobrychis crista-galli.
17787. Scorpiurus muricatus.
17788. Scorpiurus subvillosus.
17789. Scorpiurus vermiculata.
17790. Vicia grandiflora.
17791. Vicia orobus.
17792. Vicia sylvatica.
17793. Aegilops macrochaeta.
17794. Aegilops macrura.
17795. Aegilops ovata.
17796. Aegilops squarrosa.
17797. Aegilops triaristata.
17798. Aegilops triuncialis.
17799. Agropyron acutum.
17800. Agropyron muricatum.
17801. Arrhenatherum avenaceum.
17802. Arrhenatherum avenaceum bulbosum.
17803. Avena argentea.
17804. Avena atropurpurea.
17805. Avena orientalis.
17806. Dactylis altaica.
17807. Dactylis glaucescens.
17808. Dactylis hispanica.
17809. Hierochloe borealis.
17810. Holcus argenteus.
17811. Pennisetum caudatum.
17812. Pennisetum latifolium.
17813. Phalaris coerulescens.
17814. Phalaris trigyna.
17815. Phleum arenarium.
17816. Phleum asperum.
17817. Phleum boehmeri.
17818. Phleum intermedium.
17819. Phleum michelii.
17820. Phleum parnassicum.
17821. Phleum pratense.
17822. Phleum tenue.
17823. Brachypodium pinnatum.
17824. Agropyron repens.
17825. Triticum vulgare (?)
17826. Agropyron cristatum.
17827. Agropyron elymoides.
17828. Triticum firmum.
17829. Agropyron repens.
17830. Triticum turgidum.
17831. Agropyron repens.
17832. Dianthus squarrosus.

17833 and 17834. Andropogon sorghum. **Sorghum.**

From Des Moines, Iowa. Received through the Iowa Seed Company, March 3, 1906.

Amber Cane.

17835 and 17836. Ipomoea spp.

From Miami, Fla. Received through the Subtropical Laboratory and Garden (Nos. 185 and 186), March 5, 1906.

17835. Seed of a yellow-flowered variety of Ipomoea; origin, Cuba. (No. 186.)

17836. Seed of a purple-flowered variety of Ipomoea; origin, Jamaica, British West Indies. (No. 185.)

17837 to 17841.

From New York, N. Y. Received through Henry Nungesser & Co., March 5, 1906.

Grass and forage crop seeds, as follows:

17837. Agrostis alba. **Redtop.**

17838. Festuca elatior. **Tall fescue.**

17839. Ornithopus sativus. **Serradella.**

17840. Trifolium pratense. **Red clover.**

17841. Trifolium incarnatum. **Crimson clover.**

The ordinary or early crimson clover.

17842 to 17954.

From Peking, China. Received through Mr. F. N. Meyer, February 23, 1906.

A collection of seeds, as follows:

17842. Quercus dentata. **Oak.**

From Ming Tombs. "(No. 25a.) Seed obtained from the same tree as that sent under No. 12a (S. P. I. No. 18265); secured later in the season, the green leaves having changed to a gorgeous red. Probably the same as No. 24a (S. P. I. No. 17879)." (*Meyer.*) (For description see No. 18265.)

17843. (Undetermined.)

From Peking. "(No. 122a.) Seed of a plant bearing bright scarlet-colored nonedible fruits about the size of an egg." (*Meyer.*)

17844. Prunus armeniaca. **Apricot.**

From Peking. "(No. 15a.) Seed of a sweet variety of apricot sold in Peking under the name of 'almonds'; are eaten as dessert and also used in confectionery." (*Meyer.*)

17845. Prunus armeniaca. **Apricot.**

From Peking. "(No. 16a.) Seed of a bitter variety of apricot sold in Peking under the name of 'almonds'; used only in confectionery." (*Meyer.*)

17846. Aristolochia sp.

From Shan-hai-kwan. (No. 134a.)

17847. Phaseolus angularis. **Adzuki bean.**

From Chang-li. "(No. 37a.) Considered to be the best table bean in Chang-li." (*Meyer.*)

17842 to 17954—Continued.

17848. PHASEOLUS RADIATUS. **Mung bean.**

From Chang-li. "(No. 43a.) A small, edible bean; is grown between rows of sweet potatoes and also cotton; ripens before either of these crops are ready to be harvested." (*Meyer.*)

17849. VIGNA UNGUICULATA. **Cowpea.**

From Tientsin. "(No. 144a.) Used for food; also roasted for confectionery." (*Meyer.*)

17850. PHASEOLUS CALCARATUS. **Bean.**

From Shan-hai-kwan. "(No. 46a.) A small, long bean differing in shape from all other beans; used for food, especially in soups." (*Meyer.*)

17851. PHASEOLUS ANGULARIS. **Adzuki bean.**

From Tientsin. "(No. 143a.) A variety of bean used for food; also for confectionery. The beans are boiled, made in a pulp, sweetened with sugar, and baked in small cakes." (*Meyer.*)

17852. GLYCINE HISPIDA. **Soy bean.**

From Peking. "(No. 17a.) These beans are roasted and sold in Peking as delicatessen." (*Meyer.*)

17853. VICIA FABA. **Broad bean.**

From Shan-hai-kwan. "(No. 45a.) A green variety of broad bean; apparently a different strain." (*Meyer.*)

17854. RICINUS COMMUNIS. **Castor oil plant.**

From Peking. "(No. 61a.) The ordinary castor oil bean. The oil is extracted from the seeds and used in the native lamps. After frost the stalks are uprooted and used for fuel." (*Meyer.*)

17855. VIGNA UNGUICULATA. **Cowpea.**

From Shan-hai-kwan. "(No. 44a.) A light-colored bean used as food; grown between millet and sweet potatoes." (*Meyer.*)

17856. VIGNA UNGUICULATA. **Cowpea.**

From Shan-hai-kwan. "(No. 47a.) A light brown-colored bean used for food in the green and dried state; grown between rows of small millet and sweet potatoes." (*Meyer.*)

17857. GLYCINE HISPIDA. **Soy bean.**

From Shan-hai-kwan. "(No. 42a.) Used for food in Shan-hai-kwan." (*Meyer.*)

17858. PHASEOLUS VULGARIS. **Bean.**

From Tientsin. "(No. 81a.) A fine variety of Red Haricot beans; eaten when green." (*Meyer.*)

17859. PHASEOLUS VULGARIS. **Bean.**

From Peking. "(No. 18a.) *White Haricot.* These are eaten boiled as dry beans, or are used as a vegetable when fresh, and as such they are very fine. Might do well as string beans in the Atlantic States." (*Meyer.*)

17860. VICIA FABA. **Horse bean.**

From Tchang-ping-tcho. "(No. 115a.) A horse bean used for food in north China." (*Meyer.*)

17861. GLYCINE HISPIDA. **Soy bean.**

From Sachon. "(No. 28a.) A small, black soy bean grown for fodder; late variety. An excellent food for stock; must be boiled before being fed." (*Meyer.*)

17842 to 17954—Continued.

17862. GLYCINE HISPIDA. **Soy bean.**

From Tientsin. "(No. 152a.) A fine variety of soy bean used to make bean cheese from." (*Meyer.*)

17863. FAGOPYRUN ESCULENTUM. **Buckwheat.**

From Shan-hai-kwan. "(No. 48a.) A variety of buckwheat sparsely grown around Shan-hai-kwan; used for making bread." (*Meyer.*)

17864. BRASSICA PE-TSAI. **Pe-tsai cabbage.**

From Shan-hai-kwan. "(No. 58a.) An excellent, white, long-headed cabbage, which can be kept in cellars all winter. The plants love a rich, well-worked soil and can not stand drought. The Chinese irrigate them carefully, for the more they are irrigated the larger they grow. Chinese name *Pai tsay.*" (*Meyer.*)

17865. BRASSICA PE-TSAI. **Pe-tsai cabbage.**

From Tientsin. "(No. 83a.) A very small variety of green cabbage." (*Meyer.*) Apparently a mixture of several species.

17866. BRASSICA PE-TSAI. **Pe-tsai cabbage.**

From Tchang-ping-tcho. "(No. 80a.) A very heavy, long-headed white cabbage; late variety." (*Meyer.*)

17867. BRASSICA CHINENSIS. **Pak-choi cabbage.**

From Tientsin. "(No. 100a.) A short cabbage of which the midribs of the leaves get to be quite fleshy. Sold in Tientsin, but as yet I have not seen it anywhere else." (*Meyer.*)

17868. BRASSICA PE-TSAI. **Pe-tsai cabbage.**

From Chang-li. "(No. 1a.) A remarkably fine variety of white cabbage; the best I have ever seen. It is a long-headed variety and grows from 2½ to 3 feet high. The taste and smell are entirely different from any other cabbage. A very fine vegetable. Wants careful culture and can not stand drought. Known as *Shantung* cabbage." (*Meyer.*)

17869. BRASSICA PE-TSAI. **Pe-tsai cabbage.**

From Shan-hai-kwan. "(No. 101a.) Sold to me as a *Shantung* cabbage; a very good variety." (*Meyer.*)

17870. DAUCUS CAROTA. **Carrot.**

From Hsuen-hwa-fu. "(No. 30a.) A sweet, light yellow, nearly white carrot. Grows on alkaline soil." (*Meyer.*)

17871. DAUCUS CAROTA. **Carrot.**

From Tientsin. "(No. 82a.) An orange colored, medium short variety of the ordinary carrot; more in favor here than the beet-red variety." (*Meyer.*)

17872. DAUCUS CAROTA. **Carrot.**

From Tchang-ping-tcho. "(No. 66a.) A very sweet, beet-red carrot. Is used boiled as well as pickled. Loves a well-drained soil and does not want to suffer from drought." (*Meyer.*)

17873. CELASTRUS PANICULATUS (?).

From Shan-hai-kwan. "(No. 123a.) A very large variety found growing in the mountains near Shan-hai-kwan." (*Meyer.*)

17874. CELASTRUS PANICULATUS (?).

From Shan-hai-kwan. "(No. 124a.) A very small variety found growing in the mountains near Shan-hai-kwan." (*Meyer.*)

17875. CELTIS sp.

From Tang-san. ("No. 92a.) A rather large-leaved *Celtis;* useful as a small shade tree." (*Meyer.*)

17842 to 17954—Continued.

17876. Castanea sativa. **Chestnut.**

From Peking. "(No. 33a.) The largest variety to be found on the markets in Peking; said to have come from Chee-san, near Chang-li. The nuts are roasted with sand and an oily substance which bleaches them, and are remarkably sweet. The trees on which they grow are seedlings." (*Meyer.*)

17877. Castanea sativa. **Chestnut.**

From Peking. "(No. 34a.) The ordinary Chinese chestnut, sold everywhere in northern China. They are very small, but make up in sweetness what they lack in size. Are roasted the same as No. 33a (S. P. I. No. 17876), and are said to have come from Chee-san, near Chang-li. The trees I saw there grow in sheltered spots and seem to love a rocky soil." (*Meyer.*)

17878. Quercus sp. **Oak.**

From western hills near Peking. "(No. 26a.) A fine oak, resembling a chestnut. The acorns are eagerly collected and used for tanning purposes. Probably not very hardy, as it grows in quite sheltered valleys." (*Meyer.*)

17879. Quercus dentata. **Oak.**

From Tang-san. "(No. 24a.) A beautiful, large-leaved oak. The leaves assume gorgeous colors in autumn; a very desirable tree. Grows to medium dimensions." (*Meyer.*)

17880. Zea mays. **Corn.**

From Pee-san. "(No. 19a.) A very fine strain of corn growing in a rather dry part of the country. This is one of the best varieties I have seen in northern China. The plants grow about six feet high and have uniformly two ears to each stalk." (*Meyer.*)

17881. Zea mays. **Corn.**

From Shan-hai-kwan. "(No. 20a.) A white-seeded corn growing on stony soil around Shan-hai-kwan, where it gets quite cold." (*Meyer.*)

17882. Crataegus pinnatifida. **Hawthorn.**

From Chang-li. "(No. 52a.) The largest variety of *Cretaegus pinnatifida.* A fine fruit for preserves, and a very ornamental tree; is simply loaded in the fall with red berries and keeps its large, glossy, green leaves till late in autumn." (*Meyer.*)

17883. Crataegus pinnatifida. **Hawthorn.**

From Chang-li. "(No. 104a.) Fruits of different sizes to show variation." (*Meyer.*)

17884. Dolichos lablab. **Hyacinth bean.**

From western hills near Peking. "(No. 96a.) The same as No. 95a (S. P. I. No. 17885), but from a different locality." (*Meyer.*)

17885. Dolichos lablab. **Hyacinth bean.**

From Hawai-jou. "(No. 95a.) A bean which is grown around gardens as a windbreak, and at the same time the green beans are used as a vegetable; they are somewhat coarse but do not taste at all bad. The plant is a climber and as such needs supports." (*Meyer.*)

17886. Elaeagnus sp.

From Chang-li. "(No. 120a.) A silvery-leaved Elaeagnus which ripens small, red berries in October. Grows from 5 to 6 feet high. Under cultivation it might become denser headed and be an ornamental shrub." (*Meyer.*)

17887. Malus sp. **Crab apple.**

From Peking. (Not numbered by Meyer.) "A crab apple sold on the streets in Peking." (*Meyer.*)

17842 to 17954—Continued.

17888. Gleditsia sp.

From Hwai-lai. "(No. 109a.) A small tree; may be fit for a shade tree. Can apparently stand lots of cold and drought, as I found them growing on the edges of a ravine on the road to Mongolia." (*Meyer.*)

17889. Gleditsia sp.

From Wei-tsan Mountains near Peking. "(No. 106a.) An ornamental shade tree, bearing dark-brown pods. Apparently a slow grower." (*Meyer.*)

17890. Corylus sp. **Hazelnut.**

From Peking. "(No. 32a.) A small hazelnut said to have come from very far north; bought in Peking." (*Meyer.*)

17891. Humulus sp. **Hop.**

From Tientsin. "(No. 136a.) A wild hop found growing around here along banks and in thickets." (*Meyer.*)

17892. Zizyphus sativa. **Jujube.**

From Peking. "(No. 14a.) The Chinese collect the fruit and make a paste from it by boiling the fruit and straining the liquid. It is a bad weed that easily overruns dry plains. It grows over the whole Peking city wall and its spines easily break off in one's flesh. To be used for breeding purposes." (*Meyer.*)

17893. Juniperus chinensis. **Chinese juniper.**

From Tang-san. "(No. 71a.) Seeds from a very pyramidal form of the juniper. These are universally used in northern China to plant around graves, and also as windbreaks. They seem to be able to withstand much drought." (*Meyer.*)

17894. Koelreuteria paniculata. **Varnish tree.**

From Ming Tombs. "(No. 85a.) Seed from the bladderpod tree, varying in looks from the usual type." (*Meyer.*)

17895. Brassica oleracea. **Kohlrabi.**

From Hsuen-hwa-fu. "(No. 73a.) A very large variety of kohlrabi grown where the soil is strongly alkaline." (*Meyer.*)

17896. Castanea sativa. **Chestnut.**

From Tientsin. "(No. 146a.) A large variety of chestnut sold on Tientsin market; very sweet when boiled or roasted." (*Meyer.*)

17897. Acer sp. **Maple.**

From Tang-san. "(No. 27a.) A very beautiful maple which grows to be a medium-sized tree, of very characteristic form. The leaves assume gorgeous colors in the fall." (*Meyer.*)

17898. Acer sp. **Maple.**

From Wei-tsan Mountains near Peking. "(No. 67a.) An ornamental, small-leaved maple, growing wild in the mountains." (*Meyer.*)

17899. Chaetochloa italica. **Millet.**

From Chang-li. "(No. 53a.) A small variety of millet sold in Chang-li, where it is ground up and used for food." (*Meyer.*)

17900. Chaetochloa italica. **Millet.**

From Chang-li. (No. 105a.)

17901. Chaetochloa italica. **Millet.**

From Chang-li. "(No. 50a.) A variety of medium-sized millet, growing about 5 feet high; stools out very much and is, consequently, a great straw producer. The seeds are used as food, but are not valued as highly as other millets on account of the difficulty of hulling them." (*Meyer.*)

17842 to 17954—Continued.

17902. Amygdalus persica. **Peach.**

From Peking. "(No. 88a.) Seed from fruits, among which were some strange types, eaten in different places in north China." (*Meyer.*)

17903. Amygdalus persica. **Peach.**

From Shan-hai-kwan. " (No. 89a.) A hardy variety which can probably be grown very far north." (*Meyer.*)

17904. Perilla ocymoides. **Perilla.**

From Peking. "(No. 79a.) A plant grown in some localities for the production of oil, which is obtained from the seed." (*Meyer.*)

17905. Diospyros lotus. **Persimmon.**

From Chang-li. "(No. 69a.) A long-fruited, wild persimmon. The fruits are small and not borne in such great quantities as No. 57a (S. P. I. No. 17906); otherwise the same description applies to it." (*Meyer.*)

17906. Diospyros lotus. **Persimmon.**

From Chang-li. "(No. 57a.) A round-fruited, wild persimmon. The fruits are not larger than a cherry, but are very sweet tasting and the trees are heavily loaded. A valuable acquisition as a fruit and ornamental tree, also as a stock plant for the large, seedless persimmon." (*Meyer.*)

17907. Diospyros lotus. **Persimmon.**

From Nankon Pass. "(No. 31a.) Seed of the wild persimmon collected from old trees growing at elevated points and apparently at the northern limit of their kind. To be used as stock for the large, seedless persimmon, and also for its fruit and as an ornamental." (*Meyer.*)

17908. Rhamnus sp.

From Shan-hai-kwan. "(No. 132a.) A very small, shrubby Rhamnus growing wild in the mountains. Well fit for rockeries and as a very small hedge plant." (*Meyer.*)

17909. Rhamnus sp.

From Tang-san. "(No. 126a.) A large-leaved, bushy Rhamnus from 3 to 6 feet in height; loaded at time of collection with black berries. Might do well as a hedge plant, as it has long spines and is very dense." (*Meyer.*)

17910. Pinus sp. **Pine.**

From Chang-li. "(No. 129a.) The common pine found growing in Chinese cemeteries." (*Meyer.*)

17911. Pinus bungeana. **Pine.**

From Ming Tombs. (No. 108a.) The same as S. P. I. No. 17912.

17912. Pinus bungeana. **Pine.**

From Wei-tsan Mountains. "(No. 137a.) A very beautiful pine with silvery white bark; a slow grower, but extremely striking when old. The bark peels off in flakes, like the sycamore, but the foliage is not as dense as in most other pines." (*Meyer.*)

17913. Prunus sp. **Plum.**

From Peking. "(No. 90a.) Apparently a very late plum; freestone; fruits not very large, yellowish green with a purplish bloom; rather sweet in taste." (*Meyer.*)

17914. Oryza sativa. **Rice.**

From Shan-hai-kwan. "(No. 49a.) A variety of upland rice said to be a softer quality than the one sent under No. 40a (S. P. I. No. 17915)." (*Meyer.*)

17915. Oryza sativa. **Rice.**

From Shan-hai-kwan. "(No. 40a.) An upland rice grown sparingly around here. Should be hardy very far north." (*Meyer.*)

17842 to 17954—Continued.

17916. Oryza sativa. **Rice.**

From Sachon. "(No. 29a.) Bought as an upland rice, but apparently is a lowland variety. Should do well quite far north, as the place where it was raised is about 50 miles north of Peking." (*Meyer.*)

17917. Oryza sativa. **Rice.**

From Chang-li. "(No. 39a.) An upland rice cultivated around Chang-li. Should be hardy pretty far north." (*Meyer.*)

17918. Celastrus flagellaris.

From Wei-tsan Mountains, near Peking. "(No. 68a.) A small, creeping shrub, bearing red, edible berries." (*Meyer.*)

17919. Sesamum indicum. **Sesame.**

From Tientsin. "(No. 149a.) These seeds are universally used throughout China in confectionery and baked on the surface of round cakes, and as such they taste pretty good. The plants seem to like a rather rich soil, and produce many seed pods on one stalk. The Chinese also make an oil out of the seed, in which they fry nearly everything." (*Meyer.*)

17920. Andropogon sorghum. **Sorghum.**

From Pee-san. "(No. 21a.) This variety has white seeds and is used for making bread; as such it is more highly esteemed than the brown-colored varieties, which are generally only used as fodder for the domestic animals." (*Meyer.*)

17921. Andropogon sorghum. **Sorghum.**

From Pee-san. "(No. 22a.) A variety with dark brown seeds, universally used throughout north China as fodder for domestic animals. The stems of sorghum are used in building houses, the stalks being embedded in the mud walls; also for making fences, baskets, mats, tying and roofing material, and for fuel." (*Meyer.*)

17922. Andropogon sorghum. **Sorghum.**

From Pee-san. "(No. 23a.) A variety with light brown seeds, not very much grown. It is used where found as a fodder plant and also for making a brown-colored kind of bread." (*Meyer.*)

17923. Andropogon sorghum. **Sorghum.**

From Tientsin. "(No. 151a.) A superior variety of sorghum which grows from 15 to 20 feet in height. The grain is ground, and from the flour a good kind of bread is made; is used also for the same purpose as the one described under No. 22a (S. P. I. No. 17921). In addition to this the leaves are pulled off before they have turned brown, when they make an excellent cattle food, either fresh or dry. The roots are also dug and used as fuel." (*Meyer.*)

17924. Spinacia oleracea. **Spinach.**

From Tchang-ping-tcho. "(No. 55a.) An exceptionally good winter spinach, which, with a little protection from cold, produces greens the greater part of the winter. The seeds should be sown very thinly, as the plants grow rather large." (*Meyer.*)

17925. Helianthus annuus. **Sunflower.**

From western hills, near Peking. "(No. 59a.) The ordinary, single-headed sunflower, used in China in many ways. The leaves are pulled off and fed to domestic animals; the seeds are eaten as delicatessen, and the stalks are used for fuel." (*Meyer.*)

17926. Thuya orientalis. **Arborvitae.**

From Peking. "(No. 84a.) Seeds collected from old, weather-beaten trees on the grounds of the Temple of Heaven in Peking. Can stand lots of cold and drought." (*Meyer.*)

17842 to 17954—Continued.

17927. NICOTIANA sp. **Tobacco.**

From western hills near Peking. "(No. 62a.) An inferior tobacco much used by the lower classes." (*Meyer.*)

17928. NICOTIANA TABACUM. **Tobacco.**

From Chang-li. "(No. 86a.) A medium quality of tobacco grown around Chang-li." (*Meyer.*)

17929. JUGLANS hyb. (?) **Walnut.**

From Nankon Pass. "(No. 87a.) A very strange walnut. Those with highly undulated surfaces are used as a remedy for stiff fingers, and the smooth ones are eaten. A hard-shelled variety. Probably a hybridization has taken place between *J. mandshurica* and *J. regia sinensis.*" (*Meyer.*)

17930. RAPHANUS SATIVUS. **Radish.**

From Chang-li. "(No. 2a.) A giant red radish; flavor not strong. Seems to like a well-drained, sandy soil. Attains a size of from 3 to 7 inches in diameter." (*Meyer.*)

17931. RAPHANUS SATIVUS. **Radish.**

From San-kai-tien. "(No. 76a.) A red radish of elongated form. Looks very nice when exposed for sale." (*Meyer.*)

17932. RAPHANUS SATIVUS. **Radish.**

From Shan-hai-kwan. "(No. 56a.) A radish with a sweet, fresh taste; is very appetizing if cut lengthwise and eaten raw either before or with meals. These seeds have both the green and red varieties among them." (*Meyer.*)

17933. RAPHANUS SATIVUS. **Radish.**

From Shan-hai-kwan. "(No. 60a.) A late variety of a long, white radish; quite sweet and not at all strong when boiled." (*Meyer.*)

17934. RAPHANUS SATIVUS. **Radish.**

From Shan-hai-kwan. "(No. 74a.) A smaller variety than No. 2 (S. P. I. No. 17930); otherwise the same description applies to it." (*Meyer.*)

17935. RAPHANUS SATIVUS. **Radish.**

From San-kai-tien. "(No. 75a.) A very strange variety, the outside looking like a long, green turnip; wine red colored flesh. Is sliced and eaten raw as a relish." (*Meyer.*)

17936. RAPHANUS SATIVUS. **Radish.**

From Shan-hai-kwan. "(No. 77a.) A green variety; very appetizing if sliced and eaten raw." (*Meyer.*)

17937. RAPHANUS SATIVUS. **Radish.**

From Tientsin. "(No. 78a.) The same as No. 77a (S. P. I. No. 17936), but obtained in a different locality." (*Meyer.*)

17938. AMPELOPSIS sp.

From Tientsin. "(No. 70a.) An ornamental vine well fit to cover trellises or verandas; has deeply laciniate, palmate leaves, and bears yellow berries in the fall. Seems to be very hardy and able to withstand droughts." (*Meyer.*)

17939. AMPELOPSIS sp.

From Tientsin. "(No. 93a.) A vine bearing red berries, similar to No. 70a (S. P. I. No. 17938) but more ornamental." (*Meyer.*)

17940. AMPELOPSIS sp.

From Wei-tsan Mountains near Peking. "(No. 113a.) A vine bearing small, white berries; may be fit for covering fences and rough places." (*Meyer.*)

17842 to 17954—Continued.

17941. VITEX sp.

From Wei-tsan Mountains near Peking. "(No. 116a.) An aromatic plant, the peeled twigs of which are used to make fine baskets, and the flowering tops are dried and used as insect powder." (*Meyer.*)

17942. AMPELOPSIS sp.

From Shan-hai-kwan. "(No. 133a.) A vine with deeply lobed leaves and white berries; may be fit to cover rock fences or waste places." (*Meyer.*)

17943. JUGLANS REGIA. **Persian walnut.**

From Gopo, near Chang-li. "(No. 41a.) A large variety of soft-shelled walnut." (*Meyer.*)

17944. JUGLANS REGIA. **Persian walnut.**

From Peking. "(No. 35a.) A very large walnut bought in Peking." (*Meyer.*)

17945. JUGLANS REGIA. **Persian walnut.**

From Gopo, near Chang-li. "(No. 51a.) A very soft-shelled walnut; can be cracked with the hand. Not a perfect nut, though. These nuts are from one tree, which, according to the owner, produces perfectly shelled nuts on some branches and imperfectly formed ones on other branches." (*Meyer.*)

17946. JUGLANS REGIA. **Persian walnut.**

From Chang-li. "(No. 36a.) This is the genuine paper-shell walnut and as such sells for three times as much money as the hard-shelled varieties. The nuts can be peeled like peanuts. The trees are seedlings and are scattered through the groves." (*Meyer.*)

17947. TRITICUM VULGARE. **Wheat.**

From Chang-li. "(No. 38a.) A sample of the best wheat sold in Chang-li." (*Meyer.*)

17948. ROSA sp. **Rose.**

From Chang-li. "(No. 130a.) A wild rose found growing along earth banks." (*Meyer.*)

17949. WISTARIA CHINENSIS. **Chinese wistaria.**

From Tang-san. (No. 107a.)

17950. ARTEMISIA ANNUA. **Wormwood.**

From Peking. "(No. 111a.) This is the plant on which the people around here graft their chrysanthemums and on which they do well. The Chinese claim the chrysanthemum does better when grafted than when left on its own roots; they also say the grafted plants bear transplanting and lack of water much the best." (*Meyer.*)

17951. XANTHOXYLUM sp.

From Shan-hai-kwan. "(No. 125a.) A fine-leaved Xanthoxylum growing wild in the mountains near Shan-hai-kwan. Attains a height of from 4 to 5 feet, is rather ornamental, and has a very agreeable odor." (*Meyer.*)

17952. XANTHOXYLUM BUNGEI (?).

From Pee-san. "(No. 128a.) Used as a hedge plant. The seeds and fruit capsules furnish the Chinese with pepper; the fruit is pretty pungent." (*Meyer.*)

17953. BRASSICA PE-TSAI. **Pe-tsai cabbage.**

From Shan-hai-kwan. "(No. 72a.) A long-headed cabbage, late variety. Can be kept all winter in a frost-proof cellar." (*Meyer.*)

17954. CYDONIA JAPONICA. **Japanese quince.**

From Peking. "(No. 145a.) A very fragrant quince used in China to perfume a room. Grows in south China." (*Meyer.*)

17955 to 17958.

From Santiago de las Vegas, Cuba. Received through Prof. C. F. Baker, March 6, 1906.

Seeds, as follows:

17955. BAUHINIA KRUGII.

"The finest Bauhinia of the West Indies." (*Baker.*)

17956. EUGENIA PUNICIFOLIA.

"An erect, ornamental shrub with fine flowers and fruit." (*Baker.*)

17957. CANAVALIA sp. **Knife bean.**

"A nonedible, brown variety producing a great vine." (*Baker.*)

17958. PACHYRHIZUS ANGULATUS. **Yam bean.**

17959. CLEMATIS sp.

From Hwai-lai, Chi-li Province, China. Received through Mr. F. N. Meyer, February 23, 1906.

"(No. 135a.) A small clematis covering banks along ditches. Its white seed-down makes it appear like snow in the distance; not ornamental." (*Meyer.*)

17960. ARACHIS HYPOGAEA. **Peanut.**

From Amani, German East Africa. Received through Dr. A. Zimmermann, February 23, 1906.

Peanuts from Mikindani.

17961. CANNA FLACCIDA. **Canna.**

From Oneco, Fla. Received through Reasoner Bros., March 9, 1906.

17962. MISCANTHUS CONDENSATUS.

From Yokohama, Japan. Received through Suzuki & Iida, of New York City, March 6, 1906.

17963. AGROSTIS STOLONIFERA. **Creeping bent-grass.**

From New York, N. Y. Received through Henry Nungesser & Co., March 6, 1906.

17964. VITIS MUNSONIANA. **Mustang grape.**

From Elliotts Key, Fla. Received through Dr. John Gifford, March 7, 1906.

17965 and 17966.

From Brighton Beach, Wash. Received through Mr. A. B. Leckenby, March 9, 1906.

Plants, as follows:

17965. FATSIA HORRIDA. **Devil's-club.**

An araliaceous, densely prickly shrub with palmately lobed leaves and racemed or panicled umbels of small, greenish-white flowers.

17966. LYSICHITUM CAMTSCHATCENSE. **Skunk cabbage.**

A nearly stemless swamp aroid, with large leaves from a thick, horizontal root stock.

17967. BENINCASA CERIFERA. **Wax-gourd.**

From Manila, P. I. Received through Mr. W. S. Lyon, of the Bureau of Agriculture, March 5, 1906.

"Native name *Condol*. Matures fruit in four months from seed. Grown in Philippine Islands only upon trellises. When sliced and steeped over night in lime water and then boiled in a sugar sirup until it candies, it makes a most delicious glacé fruit." (*Lyon.*) (See No. 2936, Inventory No. 7, for description of this plant.)

17968 to 17972. BETA VULGARIS. **Sugar beet.**

From Lyons, N. Y. Received through the Lyons Beet Sugar Company, March 1906.

Sugar-beet seed, as follows:

17968. *Original Kleinwanzleben.*

Grown by Kleinwanzleben Sugar Company, Kleinwanzleben, Germany.

17969. *Schreiber's Specialitaet.*

Grown by G. Schreiber & Sons, Nordhausen, Germany.

17970. *Elite Kleinwanzleben.*

Grown by Dippe Bros., Quedlinberg, Germany.

17971. *Kleinwanzleben.*

Grown by F. Heine & Co., Hadmersleben, Germany.

17972. *Kleinwanzleben.*

Grown by C. Braune & Co., Bundorf, Germany.

17973 and 17974. BETA VULGARIS. **Sugar beet.**

From Lehi, Utah. Received through the Utah Sugar Company, March, 1906.

17973. *Kleinwanzleben.*

Grown by the Utah Sugar Company, Lehi, Utah.

17974. *Kleinwanzleben.*

Grown by the Fremont County Sugar Company, Sugar City, Idaho.

17975. BETA VULGARIS. **Sugar beet.**

From Caro, Mich. Received through the Peninsula Sugar Refining Company, March 10, 1906.

Kleinwanzleben. Grown by Otto Hoerning & Co., Eisleben, Germany.

17976 to 17980. BETA VULGARIS. **Sugar beet.**

From Owosso, Mich. Received through the Owosso Sugar Company, March 12, 1906.

Sugar beet seed, as follows:

17976. *Kleinwanzleben.*

Grown by Henry Mette & Co., Quedlinberg, Germany.

17977. *Kleinwanzleben.*

Grown by Rabbethge & Giesecke, Kleinwanzleben, Germany.

17978. *Kleinwanzleben.*

Grown by Wohanka & Co., Prague, Bohemia.

17979. *Kleinwanzleben.*

Grown by K. W. Kuhn & Co., Maarden, Holland.

17980. *Elite Kleinwanzleben.*

Grown by Otto Bruenstedt, Schladen-im-Harz, Germany.

17981. ASPARAGUS ACUTIFOLIUS.

From Nice, France. Presented by Dr. A. Robertson-Proschowsky. Received March 12, 1906.

"This is an evergreen plant which is found growing wild here, but never in abundance. It grows both in the woods and on sunny slopes; in some places where it is very dry, receiving no rainfall for two or three years. In such places the stems are short and quite leafy, and it is here only that they sometimes, but rarely, produce seeds. In the shade the plants produce stems several meters in length, climbing either shrubs or trees and hanging down the slopes, where they have a very graceful appearance. Young plants are readily transplanted when the roots are still fibrous, but when they become older and the roots are thick and fleshy it is impossible to transplant them. This asparagus in the wild state is quite a delicacy, and although scarce and sparingly found, the young shoots are eagerly sought for." (*Proschowsky.*)

17982 and 17983. NICOTIANA spp.

From Philadelphia, Pa. Received through Henry A. Dreer, Inc., March 5, 1906.

17982. NICOTIANA SANDERAE.

(See S. P. I. No. 17246.)

17983. NICOTIANA SANDERAE hyb.

(See S. P. I. No. 17247.)

17984. ANDROPOGON SORGHUM. **Sorghum.**

From Canadian, Tex. Received through Mr. Thomas F. Moody, March 10, 1906.

Sourless.

17985. COLOCASIA sp. **Dasheen.**

From Aguas Buenas, P. R. Received through Mr. A. W. Bowser, March 12, 1906.

Identical with S. P. I. No. 15395.

17986. COLOCASIA sp. **Taro.**

From Georgetown, S. C. Received through Mr. John Tull, March 12, 1906.

"Roots of the so-called *Yellow Tanier* of South Carolina. These roots were grown by me last year on Cat Island from roots given to me by Mr. Alex. Lucas, of Santee, S. C." (*Tull.*)

17987. COLOCASIA sp. **Taro.**

From Georgetown, S. C. Received through Mr. John Tull, March 12, 1906.

"Roots of the so-called *White Tanier* of South Carolina. These were grown by me on Cat Island last year from roots given to me by an old negro (John Huggins) who lives near here. He grows a few every year just for his own use, and has grown them from time immemorial." (*Tull.*)

17988. ARACHIS HYPOGAEA. **Peanut.**

From Yungas Valley, Bolivia. Received through Mr. Arthur L. Jackson, of La Paz, Bolivia, March 12, 1906.

17989. NICOTIANA TOMENTOSA

From Hamburg, Germany. Received through Mr. Albert Schenkel, March, 1906.

18123 to 18130.

From Bathurst, New South Wales. Presented by Prof. R. W. Peacock. Received February 13, 1906.

Samples of various native grass seeds, as follows:

18123. Eragrostis pilosa.
18124. Eleusine aegyptiaca.
18125. Diplachne fusca.
18126. Diplachne peacockii.
18127. Panicum flavidum.
18128. Panicum prolutum.
18129. Panicum decompositum.
18130. Andropogon sericeus.

18131 to 18151.

From Berkeley, Cal. Received through Prof. A. V. Stubenrauch, of the Agricultural Experiment Station, March 6, 1906.

18131. Vicia nissoliana.
18132. Vicia atropurpurea.
18133. Vicia varia.
18134. Vicia sativa obovata.
18135. Vicia pannonica.
18136. Vicia lutea.
18137. Vicia faba. **Horse bean.**

Black Spanish.

18138. Vicia sativa macrocarpa.
18139. Vicia monanthos.
18140. Vicia monanthos.
18141. Vicia calcarata.
18142. Vicia faba. **Horse bean.**
18143. Vicia faba. **Horse bean.**

Winter.

18144. Lathyrus tingitanus uniflorus.
18145. Lathyrus tingitanus.
18146. Lathyrus clymenum.
18147. Lathyrus annuus.
18148. Lathyrus ochrus.
18149. Lathyrus articulatus.
18150. Lens nigricans.
18151. Trigonella corniculata.

18152 to 18155. Chætochloa italica. **Millet.**

From Lawrence, Kans. Received through F. Barteldes & Co., March 20, 1906.

18152. *New Siberian.*
18153. *Hungarian.*
18154. *German.*
18155. Common.

18156. Ricinus communis. **Castor-oil plant.**

From Santiago de las Vegas, Cuba. Received through Prof. C. F. Baker, March 20, 1906.

A small-seeded variety.

18157. PISUM SATIVUM. **Pea.**

From Paris, France. Received through Vilmorin-Andrieux & Co., March 20, 1906.

Wax-pod.

18158 and 18159.

From Lausanne, Switzerland. Received through Prof. G. Martinet, March 21, 1906.

18158. LATHYRUS HETEROPHYLLUS.

18159. VICIA VILLOSA GLABRESCENS.

18160 to 18198. ANDROPOGON SORGHUM. **Sorghum.**

From Berlin, Germany. Presented by the Berlin Botanical Museum. Received February 14, 1906.

A collection of African sorghum seed, as follows:

18160. *Amphibolus.*
18161. *Calcareus.*
18162. *Charisianus.*
18163. *Charisianus glabrescens.*
18164. *Charisianus holstii.*
18165. *Colorans.*
18166. *Colorans.*
18167. *Colorans.*
18168. *Elegans.*
18169. *Elegans.*
18170. *Elegans.*
18171. *Inhonestus.*
18172. *Kerstingianus typicus.*
18173. *Kerstingianus typicus.*
18174. *Kerstingianus sulfureus.*
18175. *Kerstingianus sulfureus.*
18176. *Kerstingianus sulfureus.*
18177. *Kerstingianus sulfureus.*
18178. *Nitens.*
18179. *Ondongae.*
18180. *Ovulifer.*
18181. *Ovulifer.*
18182. *Ovulifer.*
18183. *Ovulifer.*
18184. *Ovulifer.*
18185. *Ovulifer.*
18186. *Ovulifer.*
18187. *Ovulifer.*
18188. *Ovulifer.*
18189. *Ovulifer.*
18190. *Ovulifer.*
18191. *Pendulus.*
18192. *Roxburghii.*
18193. *Schumannii.*
18194. *Usaramenis.*
18195. *Ziegleri.*
18196. *Elegans.*
18197. *Ovulifer.*
18198. *Ovulifer.*

18199. ELAEAGNUS hyb.

From Gotha, Fla. Received through Mr. Henry Nehrling, March 22, 1906.

18200 and 18201. ZEA MAYS. **Sweet corn.**

From North Pomfret, Vt. Received through Mr. Stephen Hewitt, March 23, 1906.

Golden Malakhov. Grown from S. P. I. No. 13256.

18200.

Amber-colored ears showing a distinct red striping; originally grown from one ear which was dark colored and very sweet.

18201.

Light amber-colored ears; sweet.

18202. VICIA FULGENS. **Scarlet vetch.**

From Paris, France. Received through Vilmorin-Andrieux & Co., March 23, 1906.

18203. ANDROPOGON SORGHUM. **Sorghum.**

From Dallas, Tex. Received through the Texas Seed and Floral Company, March 23, 1906.

Sumac Cane.

18204 to 18224. XANTHOSOMA spp. **Yautia.**

From Mayaguez, P. R. Received through the Porto Rico Agricultural Experiment Station, March 24, 1906.

A collection of yautia roots, as follows:

18204. *Rollisa.*
18205. *Punzera.*
18206. *Gris Amarilla.*
18207. *Jamaica No. 1.*
18208. *Jamaica No. 3.*
18209. *Jamaica No. 5.*
18210. *Dominica.*
18211. *Blanca.*
18212. *Prieta.*
18213. *Amarilla.*
18214. *Guayamera.*
18215. *Alocasia Marchallu.*
18216. *Jamaica No. 2.*
18217. *Jamaica No. 4.*
18218. *Jamaica No. 6.*
18219. *Islena* (Ponce).
18220. *Gengibrilla.*
18221. *Islena* (Aponte).
18222. *Orqueta.*
18223. *Rollisa Ancha.*
18224. *Jamaica* (Trinidad).

18225. ASPARAGUS ACUTIFOLIUS.

From San Giovanni a Teduccio, Italy. Received through Dammann & Co., March 26, 1906.

Roots imported for use in experiments to create a new hybrid asparagus which will resist the asparagus rust.

18226. HOSACKIA PURSHIANA. **Dakota vetch.**

From Dickinson, Dak. Received through the Dickinson Subexperiment Station, March 26, 1906.

18227. GLYCINE HISPIDA. **Soy bean.**

From Khabarovsk, East Siberia. Received through Director Gagin of the Khabarovsk Experiment Field, March 26, 1906.

Tchernie bobi. "A black variety of *Soja hispida*, which is cultivated in several places in Manchuria and Amur land." (*Gagin.*)

18228. PUERARIA THUNBERGIANA. **Kudzu.**

From Philadelphia, Pa. Received through H. A. Dreer (Incorporated), March 27, 1906.

(See Nos. 9227 and 9228, Inventory No. 9.)

18229. AVENA SATIVA. **Oat.**

From Augusta, Ga. Received through the N. L. Willet Drug Company, February 1, 1906.

Appler Rustproof. Special selection of seed from No. 17452.

18230. AVENA SATIVA. **Oat.**

From Richmond, Va. Received through T. W. Wood & Sons, January 27, 1906.

Burt. Special selection of seed from No. 17451.

18231. SECHIUM EDULE. **Chayote.**

From New Orleans, La. Received through the J. Steckler Seed Company, March, 1906.

18232. CUCUMIS MELO. **Winter muskmelon.**

From Ispahan, Persia. Received through Mr. Frank Benton (No. 33), March 27, 1906.

"Seed of a winter muskmelon grown extensively about Ispahan, Persia. It keeps, if put in a cool, airy place, all winter, and may be used at any time. Bears transportation well; many are taken over rough roads on pack animals two to three hundred miles. Oblong, light yellow, netted finely; flesh light yellow, semitransparent or watery; quite juicy; fair quality. Said to succeed best on slightly alkaline soil." (*Benton.*)

18233. BETA VULGARIS. **Sugar beet.**

From Wellsboro, Ind. Received through the West Michigan Sugar Company, March 27, 1906.

Knauer's Mangold.

18234 and 18235. AMYGDALUS spp.

From Quetta, British India. Presented by Lieut. W. L. Maxwell, One Hundred and Twenty-Seventh Baluchistan Light Infantry. Received March 24, 1906.

18234. AMYGDALUS PERSICA. **Peach.**

Quetta.

18235. AMYGDALUS PERSICA LAEVIS. **Nectarine.**

Quetta.

"These seeds were taken from the best trees in Quetta. Quetta is nearly 6,000 feet high; summer temperature, 100° F. in the shade at times; winter temperature known to drop below zero, and severe frost is known to continue for weeks at a time." (*Maxwell.*)

18236 and 18237. CHENOPODIUM QUINOA. **Quinoa.**

From La Paz, Bolivia. Received through Señor M. V. Ballovian, Ministerio de Colonias y Agricultura, March 24, 1906.

18236. CHENOPODIUM QUINOA. **Quinoa.**

Quinoa amarga or *Common.*

18237. CHENOPODIUM QUINOA. **Quinoa.**

Arrocillo or *Royal.*

(See Nos. 2931, 3073, and 3074, Inventory No. 7.)

18238 to 18240.

From Chaman, Baluchistan. Presented by Lieut. W. L. Maxwell, One Hundred and Twenty-Seventh Baluchistan Light Infantry. Received March 29, 1906.

Plants and cuttings, as follows:

18238. AMYGDALUS COMMUNIS. **Almond.**

18239. AMYGDALUS PERSICA. **Peach.**

18240. PUNICA GRANATUM. **Pomegranate.**

18241. VICIA FABA. **Broad bean.**

From Buenos Ayres, Argentina. Presented by Mr. H. B. Vannote, 11 and 13 Vandewater street, New York, N. Y. Received March 26, 1906.

18242 and 18243. PRUNUS spp. **Cherry.**

From Dreshertown, Pa. Received through Thomas Meehan & Sons, March 31, 1906.

Trees to be used as stocks upon which to bud Japanese flowering cherries, as follows:

18242. PRUNUS AVIUM. **Mazzard cherry.**

18243. PRUNUS MAHALEB. **Mahaleb cherry.**

18244. AGAVE RIGIDA SISALANA. **Sisal.**

From Miami, Fla. Collected by Mr. L. H. Dewey, March 8 and 14, 1906. Received March 31, 1906.

Bulbils secured for introduction into Porto Rico.

18245 and 18246. AVENA SATIVA. **Oat.**

From Örebro, Sweden. Received through C. A. Hagendahl's Son, March 28, 1906.

18245. *White.* **18246.** *Black.*

18247. MEDICAGO SATIVA. **Alfalfa.**

From Milwaukee, Wis. Received through the Wernich Seed Company, March 29, 1906.

Turkestan.

18248 to 18255. SOLANUM TUBEROSUM. **Potato.**

From La Paz, Bolivia. Received through Señor M. V. Ballovian, Ministerio de Colonias y Agricultura, March 24, 1906.

18248. *Ymilla.* Raised in La Paz.

18249. *Sicha.* Raised at the foot of the Sub-Andine chains.

18250. *Phureja.* Raised on the table-lands.

18251. *Luqui.* Raised on the table-lands.

18252. *Queni.* Raised in La Paz.

18253. *Apharu.* Raised on the table-land of Bolivia.

18254. *Monda.* Raised on the table-lands.

18255. *Khati.* Raised in La Paz.

18256 to 18277.

From Peking, China. Received at the Plant Introduction Gardens, Chico, Cal., through Mr. F. N. Meyer, February 26 and 27, 1906.

Seeds and cuttings of Chinese plants, the seeds indicated by the letter "a" following the number, as follows:

18256. JUGLANS REGIA. **Persian walnut.**

From Peking. "(No. 3a.) A very large, hard-shelled variety said to have come from the western mountains, where it gets quite cold." (*Meyer.*)

18257. JUGLANS REGIA. **Persian walnut.**

From Peking. "(No. 4a.) A hard-shelled, sweet variety said to have come from the mountains 40 miles north of Peking; will probably prove hardy quite far north." (*Meyer.*)

18256 to 18277—Continued.

18258. Glycine hispida. **Soy bean.**

From Pee-san. "(No. 5a.) This soy bean is extensively cultivated in the mountains north of Peking and is highly esteemed for human food; requires but little irrigation, and is well worth trying in the arid West." (*Meyer.*)

18259. Glycine hispida. **Soy bean.**

From Tschang-ping-tsu. "(No. 6a.) This bean is grown in the northern country as a nitrogen-supplying crop with sorghum, corn, or millet; does not scatter much when ripe, but seems to be late in ripening." (*Meyer.*)

18260. Prunus armeniaca. **Apricot.**

From Peking. "(No. 7a.) The so-called Chinese almond, but it is really a sweet-kerneled apricot. It is considered a fine little nut by the Chinese, who eat them salted after having them soaked in water to get rid of the skin." (*Meyer.*)

18261. Prunus armeniaca. **Apricot.**

From Peking. "(No. 8a.) The same as No. 7a (S. P. I. No. 18260), but inferior in quality; both are probably the same plant. They are said to be a special strain of apricots, being grown only for their seeds." (*Meyer.*)

18262. Amygdalus persica. **Peach.**

From Peking. "(No. 9a.) Seeds collected from a tree growing in the German Legation grounds at Peking. This tree, which is about 40 feet high, is a most heavy bearer and looks like a remarkably thrifty peach tree. Its leaves are much darker green than those of the cultivated ones. I was told that it is a fine ornamental tree in the spring, being one sheet of rose-colored blossoms." (*Meyer.*)

18263. Juglans regia. **Persian walnut.**

From Tientsin. "(No. 10a.) A small variety bought in Tientsin. May prove to be very hardy, as the nuts are small and hard." (*Meyer.*)

18264. Xanthoceras sorbifolia.

From Wei-tsan Mountains. "(No. 11a.) A small ornamental tree belonging to the horse-chestnut family. Is very well fit for a solitary lawn tree in a small garden, as it grows only to a small size and makes a dense head of foliage." (*Meyer.*)

18265. Quercus dentata. **Oak.**

From Ming Tombs, north of Peking. "(No. 12a.) This oak attains a medium size, has very large, dark green leaves, and is well worth growing; looks quite different from other oaks. Collected on the grounds of the Ming Tombs, 30 miles north of Peking, where it gets extremely cold. The trees will probably prove hardy quite far north." (*Meyer.*)

18266. Diospyros lotus. **Persimmon.**

From Pee-san. "(No. 13a.) A small persimmon used as stock for the seedless one." (*Meyer.*)

18267. Catalpa bungei. **Catalpa.**

From Wei-tsan Mountains. "(No. 78.) Young trees of which the parents have grown to a very large size in an old temple garden. This tree is one of the finest flowering trees in the world." (*Meyer.*)

18268. Tamarix sp.

From Wei-tsan Mountains. "(No. 83.) A very graceful bush, suitable for planting along the water's edge." (*Meyer.*)

18269. Populus sp. **Poplar.**

From Wei-tsan Mountains. "(No. 84.) This poplar is often found growing in old temple gardens; it has whitish bark and attains a very large size. Probably the same as No. 15 (S. P. I. No. 16915.)" (*Meyer.*)

18256 to 18277—Continued.

18270. Jasminum nudiflorum. **Jasmine.**

From Wei-tsan Mountains. "(No. 85.) A jasmine with green stems and yellow flowers, adapted for terraces and walls." (*Meyer.*)

18271. Lycium sp. **Matrimony vine.**

From Palitswang. "(No. 86.) A matrimony vine which is trained on one stem with all the small branches drooping down like a weeping tree; is loaded in the fall with red berries." (*Meyer.*)

18272. Pistacia chinensis. **Pistache.**

From Wei-tsan Mountains. "(No. 89.) The carpellate form of the Chinese pistache. A rather ornamental, small tree; bears heavy bunches of small, scarlet-purplish-colored berries." (*Meyer.*)

18273. Pistacia chinensis. **Pistache.**

From Wei-tsan Mountains. "(No. 90.) The staminate form of the Chinese pistache. A very ornamental tree with graceful, pinnate foliage; grows to very large dimensions." (*Meyer.*)

18274. Populus sp. **Poplar.**

From the mountains near Fangshan. "(No. 134.) A poplar found growing in a ravine; probably a tall-growing variety." (*Meyer.*)

18275. Morus alba. **Mulberry.**

From the mountains near Fangshan. "(No. 135.) Tall sprouts found growing by the roadside; may be a new kind." (*Meyer.*)

18276. (Undetermined.)

From the mountains near Fangshan. "(No. 136.) Cuttings of a semiclimbing, low shrub." (*Meyer.*)

18277. Koelreuteria paniculata. **Varnish tree.**

From Wei-tsan Mountains. (No. 137.)

18278 to 18293.

From Peking, China. Collected by Mr. F. N. Meyer and sent direct to the Arnold Arboretum, Jamaica Plains, Mass. Received during the winter of 1905–6.

Cuttings of Chinese plants, as follows:

18278. Euonymus sp.

From Shan-hai-kwan. "(No. 4.) A low-growing shrub with corky wings on its branches; found in semishady situations." (*Meyer.*)

18279. (Undetermined.)

From Shan-hai-kwan. "(No. 16.) A low, spreading bush with edible red berries; grows between rocks and in sunny as well as shady situations." (*Meyer.*)

18280. Ampelopsis sp.

From Shan-hai-kwan. (No. 17.)

18281. Ampelopsis sp.

From Chang-li. (No. 18.)

18282. Prunus sp.

From Shan-hai-kwan. (No. 51.)

18283. Spiraea sp.

From Shan-hai-kwan. "(No. 20.) A small, shrubby *Spiraea* resembling *S. thunbergii;* found growing between rocks and exposed places." (*Meyer.*)

18284. Ampelopsis sp.

From Chang-li. (No. 21.)

18278 to 18293—Continued.

18285. Actinidia sp. (?)

From Hwai-jou. (No. 22.)

18286. Euonymus sp.

From Hwai-jou. "(No. 24.) A very striking *Euonymus* with red leaf tops, resembling *E. bungeanus* but bearing a much larger quantity of fruit." (*Meyer.*)

18287 to 18289. (Undetermined.)

From Shan-hai-kwan. (Nos. 52 to 54.) Cuttings of unidentified shrubs.

18290. Prunus armeniaca. **Apricot.**

From Shan-hai-kwan. "(No. 55.) A wild apricot growing in a ravine near an old temple." (*Meyer.*)

18291. Spiraea sp. (?)

From Shan-hai-kwan. "(No. 56.) Found growing between the rocks in the mountains near Shan-hai-kwan." (*Meyer.*)

18292. Ampelopsis sp.

From Chang-li. "(No. 99.) A vine growing on rocky places in the mountains; has deeply lobed leaves and white berries." (*Meyer.*)

18293. Ampelopsis sp.

From Chang-li. "(No. 100.) A vine resembling *A. vetchii,* but with both entire and three-lobed leaves; assumes beautiful fall colors and though small and apparently tender is well worth trying." (*Meyer.*)

18294 to 18296.

From Peradeniya, Ceylon. Received through J. C. Willis, director of Royal Botanic Gardens, February 26, 1906.

18294. Crotalaria sp.

Imported for experimental purposes in connection with cover crops for tea and coffee plantations.

18295 and 18296. Arachis hypogaea. **Peanut.**

18295. *Mauritius.* **18296.** (Unnamed.)

18297 and 18298. Ipomoea batatas. **Sweet potato.**

From Kingston, Jamaica, British West Indies. Presented by Dr. William Fawcett, director of Hope Gardens. Received March 29, 1906.

"Tubers of the two varieties of white-skinned potato which thrive best here." (*Fawcett.*)

18297. *John Barnett.* **18298.** *Law.*

18299. Humulus lupulus. **Hop.**

From North Yakima, Wash. Presented by Mr. H. B. Scudder. Received February, 1906.

Semsch. Seeds produced on vine of S. P. I. No. 5787, in 1905. "Probably these seeds were results of pollination with pollen from the male plants of the common Yakima hop. They should be planted for selection of the best seedlings." (*Fairchild.*)

18300 and 18301. Canna spp. **Canna.**

From Palermo, Sicily. Presented by Prof. Dr. A. Borzi, director of the Botanic Gardens. Received March 30, 1906.

18300. Canna indica. **18301.** Canna iridiflora.

18302. ZEA MAYS. **Corn.**

From Callao, Peru. Presented by Mr. C. B. Cisneros. Received March 12, 1906.

18303 to 18309.

From Teheran, Persia. Presented by Mr. John Tyler, United States vice-consul-general. Received March 23, 1906.

Seeds, as follows:

18303. CUCUMIS MELO. **Muskmelon.**

A white-skinned variety.

18304. CUCUMIS MELO. **Muskmelon.**

Kharbuzzah. "This is thought to be a corruption of *khar poozah*, khar meaning ass and poozah snout or nose, possibly on account of its oblong shape. The highest quality of this kind is produced at a village 16 miles north of Ispahan, called Gurg Ab (Wolf Water), being irrigated with water impregnated with alkaline elements. The flavor is agreeably sweet and pleasant, and approved by almost every individual taste. When ripe, however, on account of the delicacy of the texture of the skin and the crispness of the inner substance it can not be transported without damage from the place where it is grown. It is said that the vibration caused to the ground by a horse cantering within a few yards will split it up, and that to pierce it with a pin is sufficient to make a circle of cracks. Such as are brought to Teheran, and those taken to towns nearer the area of growth, are cut before they are ripe and consequently lose much of their delicacy of flavor. The principal supply for the Teheran market is produced from 12 to 30 miles away, and the fruits are of various qualities, according to the soil and water supply. None are grown in the immediate vicinity of the city. The color of the *Kharbuzzah* in the best qualities is a pale yellow, but there are some nearly white or of a cream color." (*Tyler.*)

18305. CUCUMIS MELO. **Muskmelon.**

Tâlabee (Desired). "In shape a spheroid, of a greenish tinge both inside and out, although some are inclined to yellow. When good, their flavor is pleasant and rather sweet. If, however, they are deficient in sweetness, sugar may be added with advantage. In this they differ from the *Kharbuzzah*, which is not improved by sugar; in fact, many people eat it with pepper and salt. Their average weight is from 4 to 5 pounds, and I do not think that I have ever seen one that exceeded a batman (6½ pounds)." (*Tyler.*)

18306. CUCUMIS MELO. **Muskmelon.**

Garmack (Little heat). "This variety resembles in shape, size, and flavor, though not so sweet, the *Tâlabee*. It is less delicate in texture, and if of a poor quality is not much better than a Swede turnip; but as it is the first to come to market it finds considerable favor. If, however, it lacks sweetness its flavor coalesces very well with pounded sugar." (*Tyler.*)

18307. CUCUMIS SATIVUS. **Cucumber.**

Persian Khear. "A smooth-skinned variety about 5 or 6 inches in length, and the larger 6 or 7 inches in circumference. They are crisp in texture and pleasant to the taste. I think they are a little sweeter than ours, and consequently preferred by the natives. These plants, both melons and cucumbers, are planted on the margin of a trench with a bank about 4 feet wide when quite dry for the plant to lie upon, for if the fruit comes in touch with the irrigation water it brings on the rot." (*Tyler.*)

18308. CITRULLUS VULGARIS. **Watermelon.**

Andarânah. "Probably a corruption of *Hind-daneh*, meaning Indian grain or seed, partially confirming the common belief that it was originally brought from India, although it has been extensively cultivated in Persia for centuries. In some districts of eastern Persia it attains an immense size, weighing upward of 100 pounds, but in Teheran it rarely exceeds a third of that weight. Being very cheap in price, it is looked upon as a generous addition to the diet of the poor." (*Tyler.*)

18303 to 18309—Continued.

18309. ANDROPOGON SORGHUM. **Sorghum.**

(No data.)

18310. PHASEOLUS MAX. **Mung bean.**

From Barbados, British West Indies. Presented by Hon. D. Morris, Commissioner of Agriculture for the West Indies. Received April 6, 1906.

Woolly Pyrol.

18311 to 18315. ARACHIS HYPOGAEA. **Peanut.**

From Peradeniya, Ceylon. Presented by Mr. J. C. Willis, director of Royal Botanic Gardens. Received April 6, 1906.

18311. *Tanjore.*

18312. *Mauritius.*

18313. *Pondicherry.*

18314. *Barbados.*

18315. *Brazil.*

18316 to 18318. DIOSCOREA spp. **Yam.**

From Mayaguez, P. R. Presented by the Agricultural Experiment Station. Received April 4, 1906.

18316. DIOSCOREA ACULEATA GUINEA.

18317. DIOSCOREA TRIFIDA.

A white variety.

18318. DIOSCOREA TRIFIDA.

A purple variety.

18319 and 18320.

From Manila, P. I. Presented by Mr. William S. Lyon, horticulturist, Bureau of Agriculture. Received April 3, 1906.

18319. XANTHOSOMA sp. **Yautia.**

"Locally known as *Gabe de China*. Chief distinction seems to be in the size of the main rootstock, which grows very large. Grown alongside of introduced *Xanthosoma*, it made in eight months a main rootstock as large and half again, weighing, when green, nearly 2 pounds." (*Lyon.*)

18320. COLOCASIA sp.

Most common *Gabe* of the Philippine Islands.

18321. CANAVALIA ENSIFORMIS. **Sword bean.**

From Mayaguez, P. R. Presented by the Agricultural Experiment Station. Received March 27, 1906.

18322 and 18323. SACCHARUM OFFICINARUM. **Sugar cane.**

From Cienfuegos, Cuba. Presented by Dr. Robert M. Grey, Harvard Botanical Station, Central Soledad. Received March 27, 1906.

Samples of each of the following hand-fertilized sugar cane seed:

18322. *Crystallina* × *Crystallina.*

18323. *Crystallina* (female) × *Java seedling No. 51* (male).

18324. LILIUM PHILIPPINENSE. **Lily.**

From Thetford, Vt. Received through Mr. George S. Worcester, April 10, 1906.

18325. PELTANDRA SAGITTAEFOLIA. **Wampee.**

From Cat Island, South Carolina. Received through Mr. John Tull, April 9, 1906.

"The roots are extensively eaten by the colored natives." (*Tull.*)

18326. ANDROPOGON SORGHUM. **Sorghum.**

From Bombay Presidency, India. Presented by Prof. G. A. Gammie, economic botanist, Ganeshkhind Botanical Gardens, Kirkee, Poona, India. Received April 9, 1906.

"Seed of a dwarf variety of sorghum cultivated in the Punch Mahals District of the Bombay Presidency. It is locally known by the name of *Rátádia* and grows to the height of 2½ to 3½ feet." (*Gammie.*)

18327. POA TRIVIALIS. **Rough-stalked meadow grass.**

From Paris, France. Received through Vilmorin-Andrieux & Co., April 7, 1906.

18328. CUCURBITA MELANOSPERMA. **Ecuador melon.**

From Quito, Ecuador. Presented by Mr. S. Ordonez M. Received April 9, 1906.

"This plant is native to this country, where it is cultivated quite extensively and used for food for man as well as for stock. Although a perennial, it is more commonly treated as an annual and planted with corn. It is also planted along walls and at the foot of trees, upon which it will climb and produce melons continuously. The plant will not endure severe frost, and grows where the temperature ranges from 14° to 25° C.

"When used as human food the melon, as long as it is so soft that a finger nail can be driven into the shell, is simply cooked and made into different dishes with butter and salt; when ripe it is eaten cooked, with milk added at the table. For stock it is used ripe and simply cut to pieces; when cooked, however, it is far better, especially for stock and milch cows.

"The melons average 20 to 30 pounds each. The pulp is white and contains sugar and some starch. When completely ripe the shell is very hard and the seeds black, giving the melons much the appearance of a watermelon. The ripe melons can easily be kept a year in a dry and ventilated place, this condition making them valuable for winter feed. There are two varieties—the white-shelled and the green and white striped. These seeds are of the latter variety." (*S. Ordonez M.*)

18329 to 18331.

From Manila, P. I. Presented by Mr. William S. Lyon, horticulturist, Bureau of Agriculture. Received April 3, 1906.

18329. CANAVALIA ENSIFORMIS. **Knife bean.**

"'*Marautong*' of the Pampangans. The young and tender pods make an excellent snap bean, and the green as well as the fully ripe seeds are a good substitute for Lima or Haricot beans. This variety, while prostrate and rambling, is distinctively nontwining. It makes pods in two months and matures seeds in four months from planting." (*Lyon.*)

18330. CROTALARIA JUNCEA. **Sunn hemp.**

"This requires rich soil, abundant moisture, and close planting to produce long fiber. If planted wide and kept pinched it becomes very floriferous and an ornamental acquisition to the garden." (*Lyon.*)

18331. PACHYRHIZUS ANGULATUS. **Yam bean.**

18332. BETA VULGARIS. **Sugar beet.**

From Raunitz, near Wettin, Germany. Received from Mr. G. Wesche, through Mr. E. Nettwall, of Prague, Bohemia, April 11, 1906.

Wesche's Ertragreichste, or *Richest in Yield.*

18333. EUTREMA WASABI. **Japanese horse-radish.**

From Yokohama, Japan. Received through the Yokohama Nursery Company, April 11, 1906.

(For description see No. 9891, Inventory No. 10.)

18334 to 18337. ARACHIS HYPOGAEA. **Peanut.**

From Suffolk, Va. Received through the Suffolk Peanut Company, April 13, 1906.

A collection of peanuts obtained for foreign exchange, as follows;

18334. *Virginia.*

18335. *Bunch.*

18336. *Carolina.*

18337. *Spanish.*

18338. VICIA SATIVA. **Common vetch.**

From Svalöf, Sweden. Received through Allmänna Svenska Utsädesaktiebolaget, April 13, 1906.

18339. HEDYSARUM SIBIRICUM.

From Groningen, Holland. Presented by the Jardin Botanique de Groningen. Received April 12, 1906.

18340. VICIA FABA. **Broad bean.**

From London, England. Presented by Mr. S. E. Wynne. Received April 14, 1906.

Harlington White Windsor. "To grow: Plant in good, strong, rich soil in January or February for main crop, and from February to May for successive crops. Plant in rows 2 feet to 30 inches apart; when the plants are about 30 inches high cut off the tops; they need no staking. Gather the pods when young, when the seeds are not over three-fourths inch in length.

"To cook: Use plenty of water, adding a heaped tablespoonful of salt to each half gallon. Shell the beans, put them into boiling water, and boil rapidly until tender—about fifteen minutes for very young beans. Drain them thoroughly, and serve quite separately, but with a sauceboat of parsley sauce as an accompaniment. The beans are excellent with boiled bacon, but they must be cooked alone, never with the meat. If very young they should be cooked fifteen minutes; if older, twenty to twenty-five minutes, but do not overcook them. Half a peck of the pods should yield a good dish. In England they are in season in July and August.

"Average cost, 6s. per peck." (*Wynne.*)

18341. CASTANEA SATIVA. **Chestnut.**

From Yokohama, Japan. Received through the Yokohama Nursery Company, April 14, 1906.

18342. SOLANUM JAMESII.

From Grand Island, Nebr. Presented by Mr. E. Corbin. Received April 17, 1906.

(See No. 10473, Inventory No. 11.)

18343 to 18345. ANDROPOGON SORGHUM.

From Lawrence, Kans. Received through F. Barteldes & Co., April 17, 1906.

18343. *Jerusalem corn* sorghum.

18344. *Red* kafir corn.

18345. *Yellow* milo.

18346 to 18357.

From Gatton, Queensland, Australia. Presented by Prof. John Mahon, principal of the Queensland Agricultural College. Received April 18, 1906.

18346. Andropogon sericeus.
18347. Andropogon intermedius.
18348. Anthistiria ciliata.
18349. Chloris divaricata.
18350. Chloris truncata.
18351. Chrysopogon parviflora.
18352. Eragrostis brownei.
18353. Eriochloa punctata.
18354. Ischaemum pectinatum.
18355. Panicum decompositum.
18356. Panicum divaricatissimum.
18357. Andropogon australis.

18358 to 18381.

From Hanatote, Ugo, Japan. Presented by Mr. S. Nakagawa, Riku-u Agricultural Experiment Station. Received April 12, 1906.

Seeds, as follows:

18358. Brachypodium japonicum.
18359. Brachypodium japonicum.
18360. Bromus unioloides.
18361. Cassia mimosoides.
18362. Coix lacryma-jobi.
18363. Desmodium gardneri.
18364. Eleusine coracana.
18365. Eragrostis ferruginea.
18366. Eriochloa villosa.
18367. Holcus lanatus.
18368. Indigofera tinctoria.
18369. Lespedeza buergeri.
18370. Lespedeza striata.
18371. Lotus corniculatus japonicus.
18372. Miscanthus sinensis.
18373. Paspalum thunbergii.
18374. Pennisetum japonicum.
18375. Chaetochloa glauca.
18376. Chaetochloa pachystachya.
18377. Chaetochloa viridis.
18378. Chaetochloa viridis gigantea.
18379. Spodiopogon cotulifer.
18380. Vicia amoena lanata.
18381. Vicia unijuga.

18382. Macadamia ternifolia. **Queensland nut.**

From Brisbane, Queensland, Australia. Presented by Prof. F. Manson Bailey. Received April 18, 1906.

"The Queensland nut is well worthy of cultivation in Ceylon, not only as an ornamental or windbelt tree, but also for its dainty product. That it is suited to our climate may be judged from the growth of the tree at Peradeniya, where, having been introduced in 1868, it is now 40 to 50 feet high, with a spreading habit. It is indigenous to the northeastern parts of Australia, and is commonly known there as the 'Queensland nut.' It has also been referred to as the 'Australian hazelnut,' while the late Baron von Mueller described it as 'the nut tree of subtropical eastern Australia.' The tree is at first of a rather slow-growing habit, but begins to bear fruit when 6 or 7 years old, increasing in fertility until it reaches the age of 15 years.

"A writer in the Sydney Mail some time ago stated that the tree fruited freely from the time it was 8 years old, bearing at the age of 13 1,200 nuts, with which every branch was laden. Mr. W. J. Allen, in the Agricultural Gazette of New South Wales for October of last year, draws attention to the importance of growing the Queensland nut for the market. 'One farmer,' he states, 'has over an acre of these nuts, which are doing well with him and which prove themselves very profitable, finding ready sale for them at from 6d. to 7d. per pound. The nuts are retailed in the Sydney fruit shops at 1s. per pound, and are very well liked when they become known. At present the supply in our own state can not be anything like equal to the demand, and it seems to me that if these nuts were produced in quantities we should be able to find a ready sale for large supplies in Great Britain and America.' Mr. Allen describes the nut as 'one of the best-flavored on the market,' and he would recommend all those who have not tasted them to buy a few and try them.

18382—Continued.

"The nuts are borne on spikes 4 to 7 inches long, each being of the size and shape of large marbles, about three-fourths of an inch in diameter. These have an agreeable flavor, which according to some tastes is richer than that of the hazelnut. Their chief objection is, perhaps, their very hard shell, which requires extra strong nutcrackers to break.

"The tree belongs to the order Proteaceae, to which belongs also the well-known Grevillea or 'Silky Oak.' It is evergreen, with a low, branching habit; thrives best in good damp soil, and is propagated by seed. The leaves are in whorls of 3 (ternate) or 4, as the name indicates, and the flowers are creamy white, in racemes 4 to 6 inches in length, and sweet-scented." (*H. F. Macmillan, in Tropical Agriculturist, Feb., 1906.*)

18383 to 18387.

From Singapore, Straits Settlements. Presented by Prof. Henry N. Ridley, director, Botanical Gardens. Received April 17, 1906.

A collection of aroids, as follows:

18383. ALOCASIA INDICA.
18384. ALOCASIA INDICA.
18385. XANTHOSOMA VIOLACEUM.
18386. AMORPHOPHALLUS SATIVUS.
18387. AMORPHOPHALLUS CAMPANULATUS.

18388 and 18389. ANDROPOGON SORGHUM. **Sorghum.**

From Bassorah, Persian Gulf. Received through Mr. Herbert W. Poulter, April 16, 1906.

18388.

Tappo Dari. "The best quality obtainable; is planted around Bagdad and Amara. The word *Tappo*, specifying a better quality, is Turkish and represents the name of the branch of the court which looks after the collecting of the taxes on the ground. It appears that the *Dari* coming from lands held by the court was better looked after, and so a better quality obtained; hence the name *Tappo*." (*Poulter.*)

18389.

Common Dari. Planted along the Euphrates River.

18390. CYPERUS ESCULENTUS. **Chufa.**

From Valencia, Spain. Received through Hon. Henry A. Johnson, United States consul, April 19, 1906.

18391. MEDICAGO SATIVA. **Alfalfa.**

From Logan, Mont. Received through Mr. Martin Jacoby, April 18, 1906.

Turkestan alfalfa grown in 1905 from No. 9455.

18392. VITIS VINIFERA. **Grape.**

From Salonica, Turkey. Presented by Mr. J. Henry House. Received April 2, 1906.

Cuttings of the long finger grape *Valandova;* much prized for shipping to northern countries from Salonica.

18393. ANTIDESMA BUNIUS.

From Manila, P. I. Presented by Mr. W. S. Lyon, horticulturist of the Manila Bureau of Agriculture. Received April 18, 1906.

"*Bignay* of the Malays. A medium-sized, evergreen tree; highly ornamental in or out of fruit. Fruit (edible) in racemes about the size and color of the large, red *Versailles* currant." (*Lyon.*)

18394. TRIFOLIUM PRATENSE. **Red clover.**

From Riga, Russia. Received through Mr. F. Lassman, April 20, 1906.

18395. CUCURBITA MELANOSPERMA. **Ecuador melon.**

From Quito, Ecuador. Presented by Mr. S. Ordonez M. Received April 21, 1906.

White-shelled variety. (For description see No. 18328.)

18396. PISUM ARVENSE. **Field pea.**

From Ispahan, Persia. Received through Mr. Frank Benton, April 2, 1906.

"No. 34. A clover-like plant grown as a forage crop about Ispahan and known as *Guergueruh*. It is said to be an annual and seems to be used as a winter cover for land, the same as crimson clover in the United States. The plants are quite green in January after numerous frosts." (*Benton.*)

18397. CUCURBITA PEPO. **Pumpkin.**

From Shiraz, Persia. Received through Mr. Frank Benton, April 2, 1906.

"No. 35. A small, long, salmon-colored squash; enlarged at blossom end. The natives praise the quality, but as prepared for me it was watery and of poor flavor." (*Benton.*)

18398. CUCURBITA MAXIMA. **Squash.**

From Shiraz, Persia. Received through Mr. Frank Benton, April 2, 1906.

"No. 36. A medium-sized, oval, slate-colored, hard-skinned squash of indifferent quality on sale in the markets of Shiraz, in February, where seed was taken from a freshly cut specimen. Might be useful for stock. The region about Shiraz is dry and depends upon irrigation; elevation about 5,000 feet." (*Benton.*)

18399. FRAXINUS ORNUS. **Ash.**

From Nizamabad, central Persia. Received through Mr. Frank Benton, April 2, 1906.

"No. 37. Seeds taken from a cultivated ornamental tree growing near a pool of water at Nizamabad." (*Benton.*)

18400. CARICA PAPAYA. **Papaw.**

From Karachi, province of Sind, India. Received through Mr. Frank Benton, April 16, 1906.

"No. 39. Seed of a tree 20 to 30 feet tall, with large leaves, bearing fruits the size of a small muskmelon, greenish yellow outside when ripe; orange-yellow within. Grows commonly in the warmer parts of India." (*Benton.*)

18401. BRASSICA RAPA. **Turnip.**

From Quetta, Baluchistan. Received through Mr. Frank Benton, April 16, 1906.

"(No. 45.) The roots, which grow to considerable size, are flat in form and are bright crimson outside. The flesh is white, firm, and of a good quality." (*Benton.*)

18402. IPOMOEA BATATAS. **Sweet potato.**

From Quetta, Baluchistan. Received through Mr. Frank Benton, April 16, 1906.

"(No. 46.) Large sweet potatoes; red outside and quite sweet. Purchased in the market at Quetta and probably grown in the lowlands of the Indus." (*Benton.*)

18403 to 18407.

From Quetta, Baluchistan. Received through Mr. Frank Benton, April 16, 1906.

Seeds, as follows:

18403. DAUCUS CAROTA. **Carrot.**

(No. 47.)

18404. PINUS GERARDIANA. **Pine.**

(No. 48.)

18405. CUCURBITA MAXIMA. **Squash.**

(No. 49.)

18406. CUCURBITA MAXIMA. **Squash.**

(No. 50.)

18407. VITIS VINIFERA. **Grape.**

(No. 51.)

18408. SECHIUM EDULE. **Chayote.**

From Mayaguez, P. R. Received through the Agricultural Experiment Station, April 26, 1906.

Fruits of a variety of chayote which is covered with spines.

18409 and 18410. SACCHARUM OFFICINARUM. **Sugar cane.**

From Bridgetown, Barbados. Presented by Hon. Sir Daniel Morris, K. C. M. G., Commissioner of Agriculture for the British West Indies. Received April 23, 1906.

18409. *Collymns seedling.* **18410.** *Sealy seedling.*

18411. ANDROPOGON SORGHUM. **Sorghum.**

From Roswell, N. Mex. Received through Mr. G. S. Nutter, April 19, 1906.

African sumac cane.

18412. TRIFOLIUM PRATENSE. **Red clover.**

From Baltimore, Md. Received through W. G. Scarlett & Co., April 23, 1906.

Austrian.

18413 to 18421.

From New York, N. Y. Received through Henry Nungesser & Co., April 23, 1906.

A collection of seeds, as follows:

18413. AGROSTIS CANINA. **Rhode Island bent-grass.**

18414. ALOPECURUS PRATENSIS. **Meadow foxtail.**

18415. ARRHENATHERUM ELATIUS. **Tall meadow oat-grass.**

18416. BROMUS ERECTUS.

18417. FESTUCA ELATIOR. **Tall fescue.**

18418. MEDICAGO SATIVA. **Alfalfa.**

Provence.

18419. POA COMPRESSA. **Canada bluegrass.**

18420. TRIFOLIUM INCARNATUM. **Crimson clover.**

18421. TRIFOLIUM MEDIUM. **Mammoth clover.**

18422. VICIA VILLOSA. **Hairy vetch.**

From New York, N. Y. Received through Henry Nungesser & Co., April 23, 1906.

18423. ECHINACEA HELIANTHI.

From Riverton, N. J. Received through Henry A. Dreer (Incorporated), Philadelphia, Pa., April 23, 1906.

Plants obtained for hybridizing experiments.

18424. CANNA sp. **Canna.**

From Guam. Presented by Mr. H. L. W. Costenoble, superintendent of the Guam Agricultural Experiment Station. Received April 23, 1906.

"Seed of the native Guam canna, which grows to a height of 8 feet and produces blossoms uninterruptedly." (*Costenoble.*)

18425. MEDICAGO SATIVA. **Alfalfa.**

From Marblehead, Mass. Received through J. J. H. Gregory & Son, April 23, 1906.

Turkestan.

18426 and 18427.

From Juarez, Chihuahua, Mexico. Presented by Mr. Elmer Stearns, of the Agricultural College and Station. Received April 25, 1906.

18426. ZEA MAYS. **Corn.**

Flint corn from Budapest.

18427. (Undetermined.) **"Tree pea."**

18428. PASSIFLORA sp.

From Tecalitlan, Jalisco, Mexico. Presented by Mr. C. V. Mead. Received April 20, 1906.

18429 to 18458.

From Shanghai, China. Received through Mr. F. N. Meyer, April 28, 1906.

A miscellaneous collection of plants and seeds, the seeds being indicated by the letter "a" following the numbers, as follows:

18429. JUNCUS sp. **Rush.**

From Soochow. "(No. 521.) A variety of matting rush collected near Soochow. They must be grown in muddy soil with 2 to 3 inches of standing water." (*Meyer.*)

18430. JUNCUS sp. **Rush.**

From Soochow. "(No. 523.) The rush from which pith wicks for the Chinese oil lamps are made." (*Meyer.*)

18431. (Undetermined.) **"Kaba."**

From Soochow. "(No. 525.) A new vegetable, said to be very delicious; must be grown in muddy soil with 3 to 4 inches of water." (*Meyer.*)

18432. GYMNOCLADUS CHINENSIS.

From Hanchau. "(No. 202a.) A tall-growing tree with naked branches, bearing heavy pods, which are used by the Chinese as a substitute for soap. Chinese name *Soa Ache*. The tree may be of use as an ornamental tree in the Southern States." (*Meyer.*)

18433. GYMNOCLADUS CHINENSIS.

From Hanchau. "(No. 203a.) A small-podded soap tree; otherwise the same description applies to it as to No. 18432." (*Meyer.*)

18429 to 18458—Continued.

18434. VICIA FABA. **Broad bean.**

From Shanghai. "(No. 204a.) A variety of broad bean grown as a winter crop on rice fields." (*Meyer.*)

18435. CORCHORUS CAPSULARIS. **Jute.**

From Shanghai. "(No. 210a.) Seeds of the so-called *Mo-bi* fiber." (*Meyer.*)

18436. SAPINDUS UTILIS. **Soapberry.**

From near Hanchau. (No. 211a.)

18437. RAPHANUS SATIVUS. **Radish.**

From Hanchau, "(No. 212a.) A small variety of red radish with round, elongated form. Seeds were obtained through Mr. F. D. Cloud, acting consul at Hanchau." (*Meyer.*)

18438. ASTRAGALUS sp.

From Shanghai. (No. 213a.)

18439. CITRUS MEDICA. **Lemon.**

From Hanchau. "(No. 214a.) A large Chinese lemon, or possibly wild pomelo. A citrus fruit which serves the purpose here of our lemon. The fruit is very large, 4 inches long by 2½ to 3 inches wide; has loose skin which is full of a particularly pungent oil. The trees come true to seed and grow tall; branches are rather bare and full of large spines; can stand severe frosts and heavy snowfalls and may be of use as a stock plant for the northern limit of our citrus belt." (*Meyer.*)

18440. CITRUS DECUMANA. **Pomelo.**

From Shanghai. "(No. 215a.) Seeds of a large, loose-skinned, loosely segmented pomelo, which is eaten here like the orange and is not bitter at all. A fruit well worth introducing." (*Meyer.*)

18441. BRASSICA sp.

From Tang-hse near Hanchau, Che-kiang Province. "(No. 216a.) The plant producing these seeds, out of which a good edible oil is made, is only grown as a winter crop on rice fields, and the crop is ripe before the rice needs the space. The young tops of the plant are eaten boiled as a vegetable." (*Meyer.*)

18442. BRASSICA spp.

From Shanghai. (No. 217a.) Apparently a mixture of at least two varieties of Brassica.

18443. PANICUM MILIACEUM. **Broom-corn millet.**

From Shanghai. (No. 218a.)

18444. PHASEOLUS CALCARATUS. **Bean.**

From Shanghai. "(No. 236a.) A small, reddish bean used as food. Chinese name *Mu tsa.*" (*Meyer.*)

18445. PERILLA OCYMOIDES. **Perilla.**

From Shanghai. (No. 237a.)

18446. NELUMBO NUCIFERA ALBA. **White lotus.**

From Shanghai. "(No. 238a.) The seeds are highly esteemed by the Chinese as delicatessen. They boil them and roll them in powdered sugar, and they taste fine. Our confectioners might try to make the public acquainted with them." (*Meyer.*)

18447. NELUMBO NUCIFERA ROSEA. **Red lotus.**

From Shanghai. "(No. 239a.) Much cheaper than the white variety; otherwise the same description applies to it." (*Meyer.*)

18448. DOLICHOS LABLAB. **Hyacinth bean.**

From Shanghai. (No. 244a.)

18429 to 18458—Continued.

18449. RAPHANUS SATIVUS. **Radish.**

From Shanghai. "(No. 245a.) Seed of a white variety." (*Meyer.*)

18450. ABUTILON AVICENNAE. **China jute.**

From Shanghai. "(No. 246a.) Seed of a fiber-producing plant called *pa-mu.*" (*Meyer.*)

18451. CANNABIS SATIVA. **Hemp.**

From Shanghai. (No. 247a.)

18452. BRASSICA sp.

From Shanghai. (No. 248a.)

18453. CORCHORUS sp.

From Shanghai. "(No. 249a.) Seed of a fiber-producing plant 'called '*Ching-mu-tse.*' The fiber is used in weaving rush mats." (*Meyer.*)

18454. HORDEUM VULGARE. **Barley.**

From Shanghai. (No. 250a.)

18455. PISUM SATIVUM. **Pea.**

From Shanghai. (No. 251a.)

18456. (Undetermined.)

From Shanghai. (No. 252a.) A mixture of vetches and peas.

18457. TRITICUM VULGARE. **Wheat.**

From Tan-yang. (No. 253a.)

18458. HORDEUM VULGARE NUDUM. **Barley.**

From Tan-yang. "(No. 254a.) Seed of a hull-less barley obtained at Tanyang near Chinkiang, south of the Yangtze River." (*Meyer.*)

18459 and 18460. GLYCINE HISPIDA. **Soy bean.**

From West Branch, Mich. Received through Mr. Edward E. Evans, May 2, 1906.

18459. *Green.* **18460.** *Early black.*

18461. TRIFOLIUM sp. **Clover.**

From Pretoria, Transvaal. Presented by Prof. J. Burtt Davy, agrostologist and botanist of the Transvaal Department of Agriculture. Received April 30, 1906.

"*Limoru* clover seed from British East Africa, where it grows at an altitude of about 6,000 to 7,000 feet; it also appears to grow well when planted in a dry country." (*Davy.*)

18462. CUCUMIS MELO. **Muskmelon.**

From Cartagena, Colombia. Presented by Mr. Wm. R. Maxon, of San Jose, Costa Rica. Received April 28, 1906.

Seed of the native Cartagena muskmelon.

18463. ANDROPOGON CYMBARIUS.

From Central Madagascar. Presented by M. Derlandlee, of the Madagascar Department of Agriculture, Tananarivo. Received April 27, 1906.

"A good forage plant when young, and the best known of the central Madagascar species. Known by the natives as *Verotsanjy.*" (*Derlandlee.*)

18464 to 18467. ASPARAGUS spp. **Asparagus.**

From Palermo, Sicily. Presented by Prof. Dr. A. Borzi, of the Royal Botanical Gardens. Received May 2, 1906.

Asparagus roots and seeds, as follows:

18464. ASPARAGUS ACUTIFOLIUS.
(Roots.)

18465. ASPARAGUS ACUTIFOLIUS.
(Seeds.)

18466. ASPARAGUS MEDEOLOIDES.
(Seeds.)

18467. ASPARAGUS MEDEOLOIDES.
(Roots.)

18468. CITRUS TOROSA.

From Manila, P. I. Presented by Mr. William S. Lyon, horticulturist, Bureau of Agriculture. Received May 2, 1906.

18469. LEVISTICUM OFFICINALE. **Lovage.**

From Holland, Mich. Received through Mr. William Kremers, May 3, 1906.

Plants advertised by the Greening Nursery Company, of Monroe, Mich., as the "Silver King Hardy Celery." Obtained for determination.

18470. MEDICAGO MEDIA. **Sand lucern.**

From Milwaukee, Wis. Received through the Wernich Seed Company, May 3, 1906.

18471. HUMULUS LUPULUS. **Hop.**

From Stevens Point, Wis. Received through Mr. A. N. Mueller, April 28, 1906.

Bohemian.

18472 and 18473. VIGNA UNGUICULATA. **Cowpea.**

From Augusta, Ga. Received through the N. L. Willet Seed Company, May 4, 1906.

18472. *Black-eye.*

18473. *Unknown.*

18474. HARPEPHYLLUM CAFFRUM. **Kafir plum.**

From Cape Town, South Africa. Presented by Mr. C. P. Lounsbury, of the Department of Agriculture. Received May 10, 1906.

Seed collected in the Eastern Province of Cape Colony. (For description see No. 9616.)

18475. ABROMA AUGUSTA. **Anabó.**

From Manila, P. I. Presented by Mr. W. S. Lyon, horticulturist, Bureau of Agriculture. Received May 11, 1906.

"A perennial shrub producing the Anabó bast fiber." (*Lyon.*)

18476. SAPINDUS UTILIS. **Soapberry.**

From Algiers, Algeria. Received through Mr. James Johnston, United States consul, April 30, 1906.

"A native of South China, cultivated in Algeria, where it comes into bearing in eight or ten years. The tree prefers dry, rocky soil, and has been known to yield $10 to $20 worth of berries every year. These contain 38 per cent saponin, an alkaline principle which makes them useful for cleaning purposes. In eastern countries the fruit was much used before the introduction of soap and is still preferred for washing the hair and cleansing delicate fabrics like silk." (*Barclay.*)

18477. Panicum miliaceum. **Broom-corn millet.**

From New York, N. Y. Received through J. M. Thorburn & Co., May 2, 1906.

White French.

18478. Asparagus scaber.

From Frescati, near Stockholm, Sweden. Presented by Prof. Veit Wittrock. Received May 1, 1906.

Seeds obtained for hybridizing work conducted by Mr. G. W. Oliver, of this Department.

18479. Garcinia mangostana. **Mangosteen.**

From Buitenzorg, Java. Presented by Doctor Treub, director of the Botanical Gardens. Received May 5, 1906.

18480 to 18498.

From Fürstenalps, near Khur, Switzerland. Presented by Dr. F. G. Stebler, director of the Seed Control Station, Zurich. Received May 4, 1906.

A collection of hardy grass and forage plant seeds raised in Doctor Stebler's alpine garden in the Fürstenalps, near Khur, at an altitude of 5,700 feet. "These are all hardy strains which have been raised for some years in this garden and thoroughly acclimated to a short, cold growing season. That these forms are extremely hardy has been frequently proved by planting commercial seed of the same kind in these gardens, where it is invariably killed out for the most part during the first season." (*Stebler.*)

18480. Poterium dodecandrum.
18481. Festuca violacea.
18482. Poa alpina.
18483. Festuca halleri.
18484. Alopecurus pratensis.
18485. Arrhenatherum elatius.
18486. Phleum michelii.
18487. Festuca pratensis.
18488. Poterium officinale.
18489. Ligusticum mutellina.
18490. Festuca pumila.
18491. Bromus inermis.
18492. Dactylis glomerata.
18493. Oxytropis campestris.
18494. Phaca frigida.
18495. Oxytropis campestris.
18496. Hedysarum obscurum.
18497. Trifolium caespitosum.
18498. Trifolium alpinum.

18499. Pinus edulis. **Nut pine.**

From New Mexico. Received through Mr. H. B. Beck, Austin, Tex., May 1, 1906.

For exchange.

18500. Cereus sp.

From Brownsville, Tex. Received through Mr. O. W. Barrett, May 4, 1906.

18501 to 18504. Andropogon sorghum. **Sorghum.**

From Curaçao, Dutch West Indies. Presented by Mr. I. Wesleyn, Superintendent of Agriculture. Received May 8, 1906.

18501. *Doerah.*
18502. *Kabees largoe.*
18503. *Santa Martha.*
18504. Common type.

18505. CHAETOCHLOA ITALICA. **Korean millet.**

From Yokohama, Japan. Received through the Yokohama Nursery Company, May 7, 1906.

Paytupsal.

18506. TRIGONELLA FOENUM-GRAECUM. **Fenugreek.**

From Kohat, Northwest Frontier Province, India. Received through Mr. Frank Benton (No. 70), April 30, 1906.

18507. CUCUMIS MELO. **Muskmelon.**

From Lahore, India. Received through Mr. Frank Benton, April 30, 1906.

"(No. 76.) Seed from a freshly cut melon purchased in the market at Lahore, India, in March, 1906. Melon small, round; yellow, with green marking; netted. Had a strong but rather fragrant odor, which is difficult to indicate, but reminded one of musk." (*Benton.*)

18508. ACACIA FARNESIANA. **Popinac.**

From Kohat, Northwest Province, India. Received through Mr. Frank Benton (No. 73), April 30, 1906.

(See No. 3349, Inventory No. 7, and No. 3528, Inventory No. 8.)

18509. ALBIZZIA LEBBEK. **Siris tree.**

From Dera Ismail, Northwest Province, India. Received through Mr. Frank Benton (No. 74), April 30, 1906.

18510 and 18511. TRIFOLIUM PRATENSE. **Red clover.**

From Riga, Russia. Received through Mr. Heinrich Goegginger, May 9, 1906.

18510. *Ufa.*
18511. *Jeletz.*

18512 to 18517. ELEUSINE CORACANA. **Ragi.**

From Bangalore, South India. Presented by F. Fletcher, esq., Deputy Director of Agriculture, Bombay Presidency. Received April 27, 1906.

A collection of ragi:

18512. *Konanakombina.*
18513. *Janumuddina.*
18514. *Balepatte.*
18515. *Gidda.*
18516. *Sannakari.*
18517. *Gundutanekari.*

18518. ANDROPOGON SORGHUM. **Sorghum.**

From Manchuria. Received through the Yokohama Nursery Company, May 9, 1906.

"*Kaulien* sorghum of Manchuria, which forms the staple produce of that country and which has been made famous in the last year. It grows 8 to 10 feet high; the stalks and grain were indispensable for all concerned." (*Yokohama Nursery Company.*)

18519 to 18522. VIGNA UNGUICULATA. **Cowpea.**

From Richmond, Va. Received through T. W. Wood & Sons, May 9, 1906.

18519. *Clay.*
18520. *Red Ripper.*
18521. *Whippoorwill.*
18522. *New Era.*

18523 and 18524. ARACHIS HYPOGAEA. Peanut.

From Chepauk, Madras Presidency, South India. Presented by Mr. C. A. Barber, government botanist. Received May 9, 1906.

18523. *Country* groundnut. (C. A. B. No. 3153.)

18524. *Local Mauritius* groundnut. (C. A. B. No. 3154.)

18525 to 18529. MUSA SAPIENTUM. Banana.

From Manila, P. I. Presented by Mr. W. S. Lyon, horticulturist, Bureau of Agriculture. Received May 11, 1906.

18525. *Saba.*

18526. *Butuhan.*

18527. *Lacatan.*

18528. *Matabia.*

18529. *Latundan.*

18530. RAPHIDOPHORA MERRILLII.

From Manila, P. I. Presented by Mr. W. S. Lyon, horticulturist, Bureau of Agriculture. Received May 11, 1906.

18531 to 18534. ZEA MAYS. Corn.

From Juarez, Chihuahua, Mexico. Presented by Mr. Elmer Stearns. Received May 10, 1906.

Four varieties of dent corn.

18531. *Maiz blanco* (white corn).

18532. *Jaraleno.*

18533. *Temporal.*

18534. *El Coahuileno.*

18535. ACTINIDIA CHINENSIS. Yang taw.

From Kuling, Kiukiang, Kiang-si, China. Presented by Rev. Hugh W. White. Received May 15, 1905. (See S. P. I. No. 11629, Inventory No. 11.)

"The plant grows wild here, and is not known in the United States; indeed, I have seen it nowhere else in China. We find it a delicious fruit with excellent medicinal effect on the digestion. The place is about the latitude of Galveston, but it is on a mountain 3,500 feet high and has a climate not unlike Virginia or North Carolina. In winter there is an abundance of snow and ice. The subsoil is a poor, stony, red soil, but is covered with a few inches of black wood earth. There is much rainfall. The plant grows like a grape, and the fruit is single, between the size of a hickory nut and a walnut, with a russet-looking green skin and a consistency much like the green fig. If it can be cultivated it will make a valuable fruit." (*White.*)

18536 and 18537. CHENOPODIUM QUINOA. Quinoa.

From La Paz, Bolivia. Presented by Mr. Arthur L. Jackson, of the Andes Trading Company. Received May 19, 1906.

18536.

Canana. A dark-seeded variety of poor quality.

18537.

Common. A white-seeded variety most commonly grown.

"I find that there are three kinds of quinoa commonly grown here, though one is rather rare and hard to get. I am sending you samples of two varieties in this mail. The third variety is the *Quinoa Real* (or *Royal Quinoa*), which is a much taller plant. Quinoa here is principally used by the Indians. They make various kinds of foods and a drink out of it. The latter is called *Chicha* and when fermented is quite intoxicating. *Chicha* is also made out of other ingredients, such as peanuts. Quinoa is also much used as rice is used in soups, and the Indians make a dish out of it which looks like a sort of watery mush or hominy, which is not bad to eat. They also grind it up on a stone and make a kind of Indian bread, like coarse Gra-

18536 and 18537—Continued.

ham-bread, which is good and much more nutritious, or so they claim, than corn or meal bread. I have been told that quinoa does not grow well at a less altitude than about 8,000 feet." (*Jackson.*)

18538. LILIUM LONGIFLORUM EXIMIUM. **Easter lily.**

From Washington, D. C. Numbered May 23, 1906.

Plants grown from seed propagated in the Department greenhouse.

18539. CARISSA ARDUINA. **Amatungulu.**

From Cape Town, South Africa. Presented by the Corporation of the City of Cape Town Public Gardens. Received May 21, 1906.

(See No. 9612, Inventory No. 10; and Nos. 13239 and 13967, Inventory No. 11.)

18540 to 18542. HORDEUM spp. **Barley.**

From Svalöf, Sweden. Received through Dr. N. H. Nilsson, of the Swedish Seed Breeding Institute, May 24, 1906.

Pedigreed brewing barleys produced by selection and each variety said to be 100 per cent pure seed. (See Nos. 10583, 10585, and 10586, Inventory No. 11, for description.)

18540. HORDEUM DISTICHUM NUTANS.

Hannchen.

18541. HORDEUM DISTICHUM ERECTUM.

Primus.

18542. HORDEUM DISTICHUM NUTANS.

Prinsess.

18543 to 18545. SOLANUM MELONGENA. **Eggplant.**

From Cairo, Egypt. Presented by Mr. George P. Foaden, of the Khedivial Agricultural Society. Received May 26, 1906.

18543. A BLACK-FRUITED VARIETY.

18544. A WHITE-FRUITED VARIETY.

18545. A ROUND, VIOLET-FRUITED VARIETY.

18546 to 18548.

From Toledo, Ohio. Received through S. W. Flower & Co., May 26, 1906.

18546. TRIFOLIUM PRATENSE. **Red clover.**

Mammoth.

18547. TRIFOLIUM HYBRIDUM. **Alsike.**

18548. PHLEUM PRATENSE. **Timothy.**

18549. ACACIA sp. **Acacia.**

From Jammu, Kashmir. Received through Mr. Frank Benton, May 29, 1906.

"An *Acacia* which grows wild on very poor, dry, and stony soil in southern Kashmir. It is used as a hedge plant. Single specimens standing alone sometimes attain a diameter of 2 feet at base of trunk and 30 to 40 feet in height. Covered in April with a profusion of ornamental white, tassel-like blossoms, which are quite freely visited by bees and yield a fine quality of honey." (*Benton.*)

18550. CITRUS AUSTRALASICA. **Finger lime.**

From Wellington Point, near Brisbane, Queensland, Australia. Presented by Mr. James Pink. Received May 29, 1906.

(See No. 14993, Inventory No. 11.)

18551 to 18556. TRIFOLIUM PRATENSE. **Red clover.**

From Oakland, Nebr. Grown on the ranch of Mr. John P. Young from seed planted in 1905 and resown at same place in the spring of 1906.

A collection of red clover seed used in the plant life history experiments being conducted by Mr. C. J. Brand, of this Department.

18551. Missouri seed. (No. 6.)

18552. Commercial seed. (No. 9.)

18553. Nebraska seed. (No. 11.)

18554. Courland (Russia) seed. (No. 18.)

18555. Wisconsin seed. (No. 19.)

18556. Pennsylvania seed. (No. 21.)

18557 to 18560. ELEUSINE CORACANA. **Ragi.**

From Bangalore, South India. Presented by Mr. F. Fletcher, Deputy Director of Agriculture, Bombay Presidency. Received May 31, 1906.

18557. *Dodda.*

18558. *Madayangiri.*

18559. *Majjige.*

18560. *Hasarukambi.*

18561 to 18626.

From China. Received through Mr. F. N. Meyer, at the Plant Introduction Garden, Chico, Cal., May 18, 1906.

Seeds and cuttings of Chinese plants, the seeds being indicated by the letter "a" following the numbers, as follows:

18561. MORUS ALBA. **Mulberry.**

From Tang-hsi. (No. 140.)

18562. MORUS ALBA. **Mulberry.**

From Shanghai. (No. 514.)

18563. MORUS ALBA. **Mulberry.**

From Tang-hsi. (No. 520.)

18564. PITTOSPORUM TOBIRA.

From Shanghai. (No. 200a.)

18565. ZIZYPHUS SATIVA. **Jujube.**

From Peking. (No. 201a.)

18566. EUONYMUS JAPONICUS.

From Hankow. (No. 141.)

18567. EUONYMUS sp.

From Tang-hsi. (No. 142.)

18568. ELAEAGNUS sp.

From Hankow. (No. 143.)

18569. ALTINGIA CHINENSIS.

From Hankow. (No. 145.)

18570. SMILAX sp.

From Tang-hsi. (No. 146.)

18571. (Undetermined.)

From Tang-hsi. (No. 147.)

18572. DAPHNE sp.

(No. 148.)

18573. CHIMONANTHUS FRAGRANS.

From Hankow. (No. 503.)

18574. HIBISCUS SYRIACUS. **Rose of Sharon.**

From Hankow. (No. 505.) Cuttings.

18575. HIBISCUS SYRIACUS. **Rose of Sharon.**

From Hankow. (No. 192a.) Seeds.

18561 to 18626—Continued.

18576. Rosa rugosa. **Rose.**

From Shanghai. (No. 506.)

18577. Juniperus chinensis. **Chinese juniper.**

From Shan-hai-kwan. (No. 166a.)

18578. Acer mono. **Maple.**

From Wei-tsan Mountains, near Peking. (No. 169a.) Seeds sent under No. 67a, S. P. I. No. 17898.

18579. Gleditsia sp.

From Wei-tsan Mountains, near Peking. (No. 174a.)

18580. Hibiscus manihot.

From Peking. "(No. 180a.) A perennial *Althaea* or a *Hibiscus* with very large, bright yellow flowers. Brought from southern China to Peking by Dr. N. S. Hopkins, from whose son I obtained the seeds." (*Meyer.*)

18581. Lycium sp. **Matrimony vine.**

From Palitswang. "(No. 182a.) A matrimony vine which is trained on one stem, with small branches drooping down like a weeping tree. Cuttings sent under No. 86, S. P. I. No. 18271." (*Meyer.*)

18582. Rhamnus sp.

From Tchang-ping-tcho. (No. 184a.)

18583. Viburnum odoratissimum.

From Shanghai. (No. 191a.)

18584. Actinidia chinensis. **Yangtaw.**

From Hankow. "(No. 194a.) Obtained from Mr. F. J. Brown, of Hankow, who received the seeds from Ichang. Mr. Brown says it is a vine bearing nice edible fruits, something like large gooseberries, with rough skin." (*Meyer.*)

18585. Prunus sp. **Plum.**

From Tang-hsi. (No. 144.)

18586. Prunus sp. **Plum.**

From Shanghai. (No. 509.)

18587. Prunus sp. **Cherry.**

From Tang-hsi. (No. 519.)

18588. Amygdalus persica. **Peach.**

From Shanghai. (No. 501.)

18589. Amygdalus persica. **Peach.**

From Shanghai. (No. 502.)

18590. Amygdalus persica. **Peach.**

From Shanghai. (No. 508.)

18591. Amygdalus persica. **Peach.**

From Shanghai. (No. 510.)

18592. Amygdalus persica. **Peach.**

From Shanghai. (No. 511.)

18593. Amygdalus persica. **Peach.**

From Shanghai. (No. 512.)

18594. Amygdalus persica. **Peach.**

From Shanghai. (No. 513.)

18561 to 18626—Continued.

18595. AMYGDALUS DAVIDIANA (?).

From Tientsin. (No. 168a.)

18596. DIOSPYROS KAKI. **Persimmon.**

From Shanghai. "(Nos. 504 and 516.) Said to be a seedless persimmon of medium size." (*Meyer.*)

18597. DIOSPYROS KAKI. **Persimmon.**

From Tang-hsi. "(No. 517.) Said to be a large, seedless persimmon of very sweet taste." (*Meyer.*)

18598. DIOSPYROS sp. **Persimmon.**

From Tang-hsi. "(No. 518.) A persimmon growing wild in different places and used as a stock for the larger seedless ones. Is an entirely different species from the one used in northern China; has a smooth, white bark." (*Meyer.*)

18599. DIOSPYROS sp. **Persimmon.**

From Chang-li. "(No. 161a.) Seed of the wild persimmon used as stock for the large seedless varieties, and the fruits, too, are used in a semidried state, being a poor people's fruit." (*Meyer.*)

18600. MALUS MALUS. **Apple.**

From Shanghai. (No. 507.)

18601. CYDONIA JAPONICA. **Japanese quince.**

From Peking. (No. 173a.)

18602. VITIS sp. **Grape.**

From Hankow. "(No. 515.) A purple grape, bearing medium-sized bunches; said to have been introduced by the station missionaries. If so, it might be a fine grape for the South Atlantic States, as the climate in Hankow is very similar to that of the Southern States. (*Meyer.*)

18603. JUGLANS REGIA. **Persian walnut.**

From Chang-li. "(No. 162a.) A very large, paper-shell walnut, the largest one to be had. Owner was not willing to show the tree, so could not obtain scions. (*Meyer.*)

18604. JUGLANS REGIA. **Persian walnut.**

From Chang-li. "(No. 163a.) A sample of large, well-formed nuts, of which scions were sent under No. 48, S. P. I. No. 17747." (*Meyer.*)

18605. PISTACIA CHINENSIS. **Pistache.**

From Wei-tsan Mountains near Peking. (No. 170a.) The same as No. 63a, S. P. I. No. 19391.

18606. BRASSICA PE-TSAI. **Pe-tsai cabbage.**

From Hankow. (No. 193a.)

18607. SESAMUM INDICUM. **Sesame.**

From Shanghai. (No. 189a.) *Black.*

18608. MEDICAGO sp.

From Peking. (No. 183a.)

18609. (Undetermined.)

From Shan-hai-kwan. (No. 181a.)

18610. ANDROPOGON SORGHUM. **Sorghum.**

From Shan-hai-kwan. "(No. 153a) A white-grained variety of sorghum grown on rather alkaline land." (*Meyer.*)

18561 to 18626—Continued.

18611. Andropogon sorghum. **Sorghum.**

From Shan-hai-kwan. "(No. 154a.) A light brown colored variety of sorghum grown on rather alkaline land." (*Meyer.*)

18612. Andropogon sorghum. **Sorghum.**

From Shan-hai-kwan. "(No. 155a.) A dark brown colored variety of sorghum grown on rather alkaline land." (*Meyer.*)

18613. Andropogon sorghum. **Sorghum.**

From Peking. "(No. 172a.) White seeded. Given to me by Mr. J. T. Headlands, of the Methodist Mission, Peking. This is the drooping variety used to make brooms from." (*Meyer.*)

18614. Andropogon sorghum. **Sorghum.**

From Peking. (No. 172a.) Brown seeded. (For description see No. 18613.)

18615. Oryza sativa. **Rice.**

From Shan-hai-kwan. "(No. 156a.) An upland rice grown sparsely around here; seems to succeed on rather alkaline land. Should be hardy as far as New York or in Illinois. Probably the same as No. 40a (S. P. I. No. 17915), but is from a different locality." (*Meyer.*)

18616. Oryza sativa. **Rice.**

From Chang-li. "(No. 157a.) An upland rice growing on rather moist land." (*Meyer.*)

18617. Vigna unguiculata. **Cowpea.**

From Shan-hai-kwan. "(No. 158a.) A brown and white spotted bean." (*Meyer.*)

18618. Phaseolus angularis. **Adzuki bean.**

From Shanghai. (No. 187a.)

18619. Glycine hispida. **Soy bean.**

From Shanghai. "(No. 188a.) A very large variety of yellow soy bean." (*Meyer.*)

18620. Panicum miliaceum. **Broom-corn millet.**

From Shan-hai-kwan. (No. 159a.)

18621. Chaetochloa italica. **Millet.**

From Shan-hai-kwan. (No. 160a.)

18622. Chaetochloa italica. **Millet.**

From Shan-hai-kwan. (No. 165a.)

18623. Gossypium sp. **Cotton.**

From Chang-li. (No. 164a.)

18624. Sapium sebiferum. **Tallow tree.**

From Shanghai. (No. 190a.)

18625. Andropogon sorghum. **Sorghum.**

From Kung-ki-tschang. (No. 171a.) Red seeded.

18626. Andropogon sorghum. **Sorghum**

From Kung-ki-tschang. (No. 171a.) White seeded.

18627 and 18628. MEDICAGO SATIVA. **Alfalfa.**

From Bassorah, Arabia. Received from Mr. Herbert W. Poulter, through Mr. David Fairchild, June 12, 1906.

Arabian alfalfa or *Jet.*

18627. Seed from irrigated plants.

18628. Seed from unirrigated plants.

18629. MEDICAGO SATIVA. **Alfalfa.**

From Buffalo, N. Y. Received through the Harvey Seed Company, June 13, 1906.

Canadian grown alfalfa.

18630. PHOENIX DACTYLIFERA. **Date.**

From Morocco. Received through McCaig, Gilchrist & Co., Glasgow, Scotland, May 28, 1906.

Tafilalt. "Groves of this date occur in the oases of the region of Tafilalt, and this is supposed to be the largest variety grown there. It is in any case that variety which is most largely exported from Morocco, especially to the English market." (*Fairchild.*)

18631. IPOMOEA BATATAS. **Sweet potato.**

From Paoli, Ind. Presented by Braxtan Brothers. Received June 1, 1906.

This variety is of a peculiar and unusual shape, resembling a muskmelon. "Raised from a sweet potato plant and bought by us in a lot of sweet potatoes last December and kept since lying around the store with no care whatever as to its preservation, while our sweet potatoes rotted right along." (*Braxtan.*)

18632. CANNABIS SATIVA. **Hemp.**

From Shinmintong District, Manchuria. Received through the Yokohama Nursery Company, Yokohama, Japan, May 29, 1906.

"Manchurian hemp seeds produced in the district of Shinmintong, some 200 miles southwest of Kirin Province." (*Yokohama Nursery Company.*)

18633. ANDROPOGON SORGHUM. **Sorghum.**

From Turks Island, West Indies. Presented by Mr. J. A. Howells, United States consul. Received June 4, 1906.

"*Guinea corn*, the principal crop on this island for grain and fodder." (*Howells.*)

18634. XANTHOSOMA sp. **Yautia.**

From Chiapas, southern Mexico. Presented by Mr. Lawrence Harmon, of Chicago, Ill. Received April 26, 1906. Additional roots were received June 14, 1906.

Roots of a semiwild yautia found growing wild in Chiapas; said to be eaten by the natives, but not cultivated by them.

"These were shipped from the city of San Juan Bautista, Tabasco, Mexico, and it is supposed that they were brought into that city by the peons, who gathered them in that immediate vicinity. It is further understood that there is no systematic attempt made to cultivate them, and that they practically grow wild under varying circumstances, which might in some measure account for variations found in them." (*Harmon.*)

18635. PISTACIA CABULICA (?).

From Chaman, British India. Presented by Lieut. W. L. Maxwell, One Hundred and Twenty-Seventh Baluchistan Light Infantry. Received June 4, 1906.

"These wild nuts are much eaten by the Pathans around here. With regard to planting them, the following information may be useful: The Pathans say that a new tree only grows where one of the hill partridges eats a nut and passes it through in its excreta on to suitable ground. I asked the forest officer in Quetta if there could be any truth in this extraordinary statement. He told me that he had several trees growing in the Quetta plantations, and that all had been grown from seed so treated. The reason presumably is that the oil, in which these nuts are very rich, must first be extracted from the seeds. I heard from a cultivator here that if the seeds were well rubbed between the hands until all the oil was extracted, satisfactory results were obtained from planting them. The seeds ripen in August." (*Maxwell.*)

18636. PISTACIA VERA. **Pistache.**

From Viernyi, Semiryetchensk Province, Turkestan. Presented by Mr. E. Valneff, through Mr. E. A. Bessey, of the Subtropical Labratory, Miami, Fla. Received June 4, 1906.

"Pistache seeds from north Persia, the best that we know." (*Valneff.*)

18637. PISTACIA INTEGERRIMA. **Zebra wood.**

From Khost, India. Presented by Mr. Philip Parker, of the Indian Irrigation Service, through Mr. J. S. Davis, executive engineer, Bannu, Kuram Valley Irrigation Project. Received June 4, 1906.

"This is the famous zebra wood of Kakra, India, which grows to be a large tree 40 feet or more high, with a trunk in diameter from 2½ to 3 feet, or even as much as 4½ feet. It grows on the warm slopes of the Himalaya Mountains in northern India, usually at an altitude of from 1,200 to 8,000 feet. The wood is very hard and close grained, brown in color, and beautifully mottled with yellow and dark veins, whence the name 'zebra wood.'

"Stewart and Brandis, in their 'Forest Flora of Northwest and Central India,' say: 'The heartwood of mature trees is the best and most handsome wood of the northwest Himalaya for carving, furniture, and all kinds of ornamental work.'

"According to Mr. Bolton, settlement officer at Dehra Ishmail Kahn, this species is difficult to cultivate, 'as it is necessary for the seed to pass through the intestines of a bird before it can germinate.'

"Mr. Parker writes as follows: 'I gave one seed to a bird (fowl) that was to be killed the next day and told my cook to give me the seed when drawing the bird. I have just noticed that the seed, after being put in water, has begun to germinate, so evidently the Indian fowl is good enough.'

"This species is very little known, but it is of some promise as an ornamental and even perhaps as a timber tree in some parts of the southwest." (*Swingle.*)

18638. AGAVE RIGIDA SISALANA. **Sisal.**

From Paramaribo, Surinam. Presented by Dr. C. J J. Van Hall, Director of Agriculture for the Dutch West Indies. Received at the Porto Rico Agricultural Experiment Station, Mayaguez, P. R., in May, 1906.

"Parent plants are believed to be direct descendants of plants in the Trinidad Botanical Gardens which were brought from Yucatan, Mexico." (*Barrett.*)

18639 and 18640. ONOBRYCHIS ONOBRYCHIS. **Sainfoin.**

From Paris, France. Received through Vilmorin-Andrieux & Co., June 4, 1904.

18639. Double. **18640.** Common.

18641 to 18651. CYAMOPSIS TETRAGONOLOBA. **Guar.**

From Surat, India. Presented by Mr. F. Fletcher, Deputy Director of Agriculture, Bombay Presidency. Received June 4, 1906.

Nadiad varieties:

18641.

Sotia. The seed of this variety is principally used as cattle food. It is also sown in beds of ginger, turmeric, etc., to serve as shade plants to young shoots.

18642.

Wakardia. The pods of this variety are used as a green vegetable.

18643.

Telia. This is also sown for vegetable purposes, but it is considered superior to *Wakardia* on account of its being more smooth.

18644.

Pardeshi. Used as a vegetable.

Surat varieties:

18645.

Talabda. Seed used as cattle food.

18646.

Sotia. Chiefly used as a vegetable; but in the case of valuable garden crops, such as ginger, turmeric, suran, etc., it serves a double purpose, viz, as a shade plant and as green manure.

18647.

Makhania. Used only as a vegetable.

Dhulia varieties:

18648.

Botkya. A short-podded variety used as a vegetable.

18649.

Telia. A long-podded variety used as a vegetable; cooks better than the *Botkya.*

Dharwar varieties:

18650.

Turai chavali. Used as a vegetable.

18651.

Chole chavali. Used as a vegetable.

18652 to 18661. DIOSCOREA spp. **Yam.**

From Mayaguez, P. R. Received at the Subtropical Laboratory and Garden, Miami, Fla., in May, 1906.

A collection of yams, as follows:

18652. DIOSCOREA TRIFIDA.

Negro or *Yampee* (ex Jamaica).

18653. DIOSCOREA TRIFIDA.

Mapuey Blanco. White roots.

18654. DIOSCOREA TRIFIDA.

Mapuey Colorado. Purple roots.

18655. DIOSCOREA PENTAPHYLLA (?).

(Ex Hawaii.)

18652 to 18661—Continued.

18656. DIOSCOREA BULBIFERA.

Gunda. Large irregular-shaped axillary bulbils.

18657. DIOSCOREA ALATA (?).

Barbados Table (ex Jamaica).

18658. DIOSCOREA ALATA (?).

White Lisbon (ex Jamaica).

18659. DIOSCOREA ACULEATA.

Lucia (ex Jamaica).

18660. DIOSCOREA ACULEATA.

Guinea. Best yam in Porto Rico from cultural standpoint.

18661. DIOSCOREA ACULEATA (?).

Congo. Yellow root.

18662. ASPARAGUS sp.

From Peking, China. Received through Mr. F. N. Meyer, June 4, 1906.

"Berry taken from a plant growing in the Temple of Heaven grounds in Peking, September 2, 1905." (*Meyer.*)

18663 and 18664.

From Darmstadt, Germany. Received through Mr. Conrad Appel, June 4, 1906.

18663. POA TRIVIALIS. **Rough-stalked meadow grass.**

18664. MEDICAGO SATIVA. **Alfalfa.**

Provence.

18665. PINUS INSULARIS. **Benguet pine.**

From Manila, P. I. Presented by Capt. George P. Ahern, Director of Forestry. Received June 4, 1906.

Seed obtained from Benguet Province.

18666. HORDEUM DISTICHUM NUTANS. **Barley.**

From Brünn, Austria. Presented by Prof. J. Vanha. Received in March, 1906.

Hanna.

18667 to 18673.

From Cape Town, South Africa. Presented by the director of the Cape Town Public Gardens. Received June 2, 1906.

18667. ABERIA CAFFRA. **Kei-apple.**

18668. ASPARAGUS CRISPUS.

18669. ASPARAGUS SARMENTOSUS.

18670. ASPARAGUS SPRENGERI.

18671. CARISSA ARDUINA. **Amatungulu.**

18672. DIOSMA CRENATA. **Buchu.**

18673. OPUNTIA sp. **Prickly pear.**

18674. VICIA SATIVA. **Common vetch.**

From Portland, Oreg. Received through the Portland Seed Company, June 7, 1906.

18675 and 18676. ARACHIS HYPOGAEA. **Peanut.**

From Muanza, German East Africa. Presented by Prof. Dr. A. Zimmermann, Amani. Received June 8, 1906.

18675. A variety with red skin.

18676. A variety with brown skin.

18677. MEDICAGO SATIVA. **Alfalfa.**

From Traverse City, Mich. Received through Mr. J. M. Westgate, June 11, 1906.

Seed gathered from two-year-old plant on the farm of Mr. C. R. Dockeray, Traverse City, Mich., June 1, 1905.

18678. MEDICAGO SATIVA. **Alfalfa.**

From Split Rock, N. Y. Received through Prof. A. S. Hitchcock, June 11, 1906.

Seed gathered October 6, 1904.

18679 and 18680. ZEA MAYS. **Corn.**

From Magyar Óvár, Hungary. Presented by Prof. Kern Hermann, through Mr. Edgar Brown. Received June 2, 1906.

Two varieties of flint corn, as follows:

18679. *Cinquatino.* **18680.** *Sehr früher von Alcinth.*

"These two corns are varieties of the small early flint type which is now being cultivated to a considerable extent in Hungary. They are very small in size, the ears about 6 inches long, with the kernels about the size of our larger popcorns. The grains are nearly free from starch, with a rather large embryo. On account of the small size of the stalks, this corn is planted close together, the rows being about 20 inches apart and the hills from 8 to 10 inches apart in the row. The average yield is from 20 to 25 bushels per acre." (*Brown.*)

18681 to 18683.

From Teheran, Persia. Presented by Mr. John Tyler, United States vice-consul-general. Received June 1 and 11, 1906.

18681. PAPAVER SOMNIFERUM. **Opium poppy.**

18682. NICOTIANA TABACUM. **Tobacco.**

18683. PISTACIA VERA. **Pistache.**

"Persian 'Pista' grown in the district of Damghân, about 200 miles east of Teheran. Nuts from this place have the reputation of being the best, purest, and most qualified to resist attacks of parasites." (*Tyler.*)

18684. ANDROPOGON SORGHUM. **Milo.**

From Memphis, Tex. Received through Mr. J. F. Bradley, June 13, 1906.

Extra Dwarf.

18685 to 18688.

From Honolulu, Hawaii. Presented by Hon. David Haughs, acting director of Forestry. Received June 11, 1906.

18685. BAUHINIA TOMENTOSA. **St. Thomas tree.**

18686. CASUARINA GLAUCA. **Blue ironwood.**

18687. CASUARINA STRICTA. **Australian ironwood.**

18688. SYNCARPIA LAURIFOLIA. **Turpentine tree.**

18689 to 18691. CHENOPODIUM QUINOA. **Quinoa.**

From La Paz, Bolivia. Received through Señor M. V. Ballovian, Ministerio de Colonias y Agricultura, June 14, 1906.

18689. *Common.*

18690. *Royal.*

18691. *Kanagua.*

(See Nos. 18536 and 18537.)

18692. TRIFOLIUM REPENS. **White clover.**

From Lodi, Italy. Received through Prof. Carlo Besana, June 16, 1906. Introduced by Mr. Edgar Brown, of the Bureau of Plant Industry.

Lodino.

18693 to 18698. PHOENIX DACTYLIFERA. **Date.**

From M'Zab, in the Algerian Sahara. Received through Mr. Yahia ben Kassem, June 16, 1906.

According to Mr. Yahia ben Kassem this lot includes the varieties *Tazzizaoute* and *Bent Kbala.* Upon examination of the offshoots, however, Mr. Swingle found a label, written in Arabic, upon each of the plants, which he succeeded in deciphering as *Timjoohert,* which is described in his letter as follows:

Timjoohert. A soft date from the M'Zab region of the Algerian Sahara; fruit of a rich, red-brown color when ripe, 1½ to 1¾ inches long, three-fourths to seven-eighths inch wide; flesh without fiber, very sweet, and of exceedingly good flavor, considered by some to be superior to the *Deglet noor.* It is a sticky date and its sirupy juice exudes from the ripening fruit in such abundance as to drip from the tree. It will require a process of curing to get rid of this sirup, but this variety is of such good quality that it may, nevertheless, prove profitable in commercial culture, especially in regions where the *Deglet noor* can not mature. It may furnish a good second-class date which can be sold in competition with the selected Oriental dates which now reach our markets from Busra and Muscat.

18699 and 18700.

From Darmstadt, Germany. Received through A. Le Coq & Co., June 16, 1906.

18699. MELILOTUS ALBA. **Sweet clover.**

Bokhara.

18700. VICIA VILLOSA. **Hairy vetch.**

18701 to 18703.

From Reading, England. Received through Sutton & Sons, June 15, 1906.

18701. CRAMBE MARITIMA. **Sea kale.**

18702. CYNARA SCOLYMUS. **Artichoke.**

Purple Globe.

18703. CYNARA SCOLYMUS. **Artichoke.**

Selected Large Green.

18704. CHRYSOPHYLLUM sp.

From Piracicaba, Brazil. Presented by Dr. J. W. Hart, director of the Agricultural College. Received June 7, 1906.

18705. PANICUM LAEVIFOLIUM.

From Pretoria, Transvaal. Presented by Prof. J. Burtt Davy, of the Transvaal Department of Agriculture. Received June 18, 1906.

18706. AMYGDALUS DAVIDIANA.

From Peking, China. Received through Mr. F. N. Meyer (No. 167a), May 18, 1906.

Seeds of the wild peach, scions of which were sent under Nos. 126, 127, and 129 (S. P. I. Nos. 17729 to 17731); from the mountains near Fangshan.

18707. GLYCINE HISPIDA. **Soy bean.**

From China. Renumbered for convenience in recording distribution, June 21, 1906.

A dull reddish brown colored variety of soy beans, the actual source of which is in doubt.

18708 to 18725.

From San Jose, Costa Rica. Presented by Mr. E. C. Rost, through Mr. L. C. Corbett, horticulturist of the Bureau of Plant Industry. Received June 20, 1906.

A collection mostly of economic plants, with notes by Mr. E. C. Rost.

18708. (Undetermined.)

An evergreen vine with white, star-shaped flowers.

18709. (Undetermined.) **Palm.**

18710. CARICA PAPAYA. **Papaw.**

18711. IPOMOEA sp. **Morning-glory.**

Seed of a wild variety.

18712. IPOMOEA sp. **Morning-glory.**

Blue Giant.

18713. CANNA sp.

18714. (Undetermined.) **Gavilana.**

A tree with leaves like the American mountain ash; has yellow flowers somewhat resembling the locust. Should do well in the extreme south.

18715. ANONA sp.

18716. COBAEA SCANDENS.

18717. MUCUNA sp.

18718. (Undetermined.)

18719. ARGEMONE MEXICANA. **Mexican poppy.**

18720. (Undetermined.)

Seed, in a flat, round, spiny pod resembling a sea urchin. Grows on a tall tree with yellow flowers.

18721. GOSSYPIUM sp. **Cotton.**

A few seeds of everbearing, large, native tree cotton.

18722. SOLANUM TUBEROSUM. **Potato.**

Pacaya.

18723. SOLANUM TUBEROSUM. **Potato.**

A potato introduced from Peru.

18724. SOLANUM TUBEROSUM. **Potato.**

A yellow-colored potato introduced from Peru.

18725. SOLANUM TUBEROSUM. **Potato.**

A dark wine-colored potato introduced from Peru.

18726. DOLICHOS LUBIA.

From Paris, France. Received through Messrs. Vilmorin-Andrieux & Co., June 22, 1906.

18727 to 18749.

From Bahama Islands, British West Indies. Collected by Mr. P. J. Wester in April, 1906.

A collection of plants, seeds, and cuttings thought to be of value in the subtropical region of Florida, either as economics or ornamentals, the proximity to the Bahamas and nearly similar climatic conditions making it very probable that these introductions will thrive well in the vicinity of Miami, where they have been planted in the Subtropical Laboratory and Garden.

The accompanying notes are by Mr. Wester.

18727. CITRUS DECUMANA. **Pomelo.**

"Mr. Flagler is reported to have said that he ate better pomelos in the Bahamas, from seedling trees, than any that he tasted in Florida. Upon inquiry it was found that some of this fruit had been supplied by R. S. Johnstone, circuit judge, Nassau, New Providence, Bahamas, who, on solicitation, presented me with budwood from two seedling trees, the fruit of which he considered very superior. The fruit is said to be rather small, but very juicy and sweet." (Lab. No. 460.)

18728. CITRUS DECUMANA. **Pomelo.**

"Fruit said to be of superior value. Budwood presented by Judge R. S. Johnstone." (Lab. No. 461.)

18729. PERSEA GRATISSIMA. **Avocado.**

Johnstone. "Budwood secured through Judge R. S. Johnstone, who gave the following description of the fruit: 'Pear-shaped, but rather broad at basal end; skin smooth, thin; flesh yellow, almond-flavored; seed large; famous as the best avocado in the Bahamas. Ripens in August and September.'" (Lab. No. 462.)

18730. PERSEA GRATISSIMA. **Avocado.**

Largo. "Budwood presented by Mr. C. H. Matthews, from a large tree. He described the fruit as follows: 'Egg-shaped; very large, 3½ to 4 pounds in weight; skin green, very thin; flavor very good; seed small; ripens in August and September.'" (Lab. No. 464.)

18731. PERSEA GRATISSIMA. **Avocado.**

Grant. "Buds secured from a tree in Grantown, said by its colored owner to bear extra early fruit of good quality. The young fruits were well advanced in size for the season when the budwood was obtained, which seemed to substantiate the owner's assertion." (Lab. No. 465.)

18732. HIBISCUS ROSA-SINENSIS. **Chinese hibiscus.**

"Budwood secured from plants in the garden of Hotel Colonial, Nassau, New Providence. Flowers distinct from any of the forms seen in Florida; semidouble, very dark red with a purple tinge, making it a distinct acquisition." (Lab. No. 467.)

18733. VANILLA sp.

"Plants collected on Soldiers road, New Providence. This vanilla grows on land of a very rocky character with a scanty layer of soil. The vegetation does not exceed 12 feet, and the average height of a shrub is 8 feet. It was interesting to note that the foliage was very sparse, affording very little shade. The growth of the vanilla was exceedingly stocky and strong. In appearance the plant resembles the *V. eggersii* in Florida, except that the bract-like leaves of the latter are entirely absent in the Bahama species. The nodes on the latter species are also closer than those on the species from Florida." (Lab. No. 470.)

18727 to 18749—Continued.

18734. FICUS BENJAMINA.

"Used as a shade tree on the streets of Nassau, New Providence. Unquestionably one of the most noble and majestic of shade trees, with dark evergreen foliage. Appears to stand the dust and heat of the street better than any tree I have seen. Cuttings presented by M. Clavel, head gardener, Hotel Colonial, Nassau, New Providence." (Lab. No. 473.)

18735. (Undetermined.)

"Native name 'Spanish Thyme.' A plant belonging to the family Scrophulariaceae, with fleshy, succulent leaves used in the Bahamas for flavoring soups. Cuttings secured in Grantown, New Providence." (Lab. No. 474.)

18736. ANONA RETICULATA. **Custard apple.**

"Budwood secured from a tree in Grantown, having very large fruit, 14½ inches in circumference. Fruit heart-shaped, yellow, netted with crimson veins, crimson on one side, making it exceedingly handsome; tree said by owner to be very prolific. Fruit of good quality." (Lab. No. 478.)

18737. ANONA MURICATA. **Soursop.**

"Budwood secured from a prodigiously prolific tree. As fruits were not mature, there was no opportunity to judge of the quality." (Lab. No. 484.)

18738. TAMARINDUS INDICA. **Tamarind.**

"Budwood obtained from Judge R. S. Johnstone, Nassau, New Providence. Pods with the acid so reduced as to make them relished when eaten direct from the tree, which is unusual with this fruit." (Lab. No. 487.)

18739. ALTHAEA ROSEA. **Hollyhock.**

"A striking and conspicuous ornamental in Nassau, where it has become naturalized." (Lab. No. 489.)

18740. BASELLA ALBA. **Malabar nightshade.**

"Native name 'Spinach.' A plant of running and climbing habit of exceedingly vigorous growth. The leaves have a very close resemblance to spinach in form, whose tenderness and succulency they possess, and are used as spinach in the Bahamas. As the plants thrive well even during the summer months, it is thought that they will prove a valuable acquisition to the vegetable garden in south Florida during the summer months. Seed secured in Grantown, New Providence." (Lab. No. 490.)

18741. CATESBAEA SPINOSA.

"Seed obtained from M. Clavel, head gardener, Hotel Colonial. Leaves evergreen, thick and leathery; branches armed with stout spines, making it a valuable hedge plant; flowers attractive, bell shaped, cream colored." (Lab. No. 492.)

18742. ZEA MAYS. **Corn.**

"*Native yellow* corn presented by Mr. W. M. Cunningham, curator, Botanic Station, Nassau, New Providence. This is a variety of corn collected by Mr. Cunningham, together with Nos. 18743 to 18745, on the various islands where these varieties do quite well. South Florida has at present no variety suited to its conditions, and as the climate here and in the Bahamas is very similar, it is not improbable that some of these varieties may prove valuable introductions." (Lab. No. 495.)

18743. ZEA MAYS. **Corn.**

Governor. "Presented by Mr. W. M. Cunningham. Native to the Bahama Islands." (Lab. No. 496.)

18744. ZEA MAYS. **Corn.**

Native white. "Native to the Bahamas. Presented by Mr. W. M. Cunningham." (Lab. No. 497.)

18727 to 18749—Continued.

18745. Zea mays. **Corn.**

Caicos yellow. "Native to the Bahamas. Presented by Mr. W. M. Cunningham." (Lab. No. 425.)

18746. Dolichos lablab. **Hyacinth bean.**

"Native name *Bonavis*. A very vigorous climbing and trailing plant, foliage resembling the cowpea, but far more vigorous. Stems slightly tinged with purple; seeds dark brown with velvety luster. Seed secured from plants growing in Grantown, New Providence." (Lab. No. 488.)

18747. Dolichos lablab. **Hyacinth bean.**

"Native name *Bonavis*. A leguminous plant with habits similar to No. 18746. The purple tinge of the stem is absent; flowers are creamy white; seed white, and much relished by the natives in cooking. Seed secured from plants growing in Grantown, New Providence." (Lab. No. 499.)

18748. Pharbitis sp. **Morning-glory.**

"Seed collected from native plants in Nassau, New Providence. Plants climbing, but seldom 4 feet in height; foliage tomentose; flowers pale blue, about 2 inches in diameter, exceedingly ornamental and strikingly different from species of Ipomoea."

18749. Reseda sp. **Mignonette.**

"Seed obtained from Mr. C. H. Matthews, Nassau, New Providence. A very handsome ornamental; leaves pinnatifid, of a silvery white tinge; stems 2 feet, bare, with a long spike of white flowers. A perennial."

18750. SINAPIS ALBA. **White mustard.**

From Moscow, Russia. Received through Immer & Son, June 25, 1906.

Sarepta.

18751. MEDICAGO SATIVA. **Alfalfa.**

From New York, N. Y. Received through H. Nungesser & Co., June 25, 1906.

Turkestan.

18752 to 18763.

From Singapore, Straits Settlements. Presented by Prof. H. N. Ridley, director of the Botanic Gardens. Received June 29, 1906.

18752. Amorphophallus prainii.
18753. Amorphophallus rex.
18754. Amorphophallus sativus.
18755. Alocasia lowii.
18756. Alocasia grandis.
18757. Alocasia longiloba.
18758. Alocasia indica.
18759. Alocasia singaporensis.
18760. Alocasia macrorhiza.
18761. Xanthosoma violaceum.
18762. Xanthosoma robustum.
18763. Typhonium tribolatum.

18764. ASPARAGUS MYRIOCLADUS.

From Berea, Durban, Natal. Presented by J. Medley Wood, director of the Natal Botanic Gardens. Received June 30, 1906.

18765. GARCINIA XANTHOCHYMUS.

From Honolulu, Hawaii. Presented by Mr. E. W. Jordan, through Mr. Gerrit P. Wilder. Received July 2, 1906.

18766 to 18770.

From Piracicaba, Brazil. Presented by Dr. J. W. Hart, director of the Agricultural College. Received June 7, 1906.

18766. ANONA sp.

Ariticu or *Cabeca de negro* (negro head). "Segmented fruit, heart-shaped, about 20 centimeters in diameter, sweet, aromatic, edible. Tree 15 meters, spreading, grows on poor, sandy land on the open prairie." (*Hart.*) (No. 16.

18767. ANONA sp.

Fruita de Conde. "Similar to preceding, but the fruit is much superior. This variety has been domesticated." (*Hart.*) (No. 17.)

18768. ARAUCARIA BRASILIANA.

(No. 22.)

18769. PSIDIUM GUAJAVA. **Guava.**

Red. (No. 12.)

18770. PSIDIUM GUAJAVA. **Guava.**

White. (No. 13.)

18771 and 18772.

From Salisbury, Rhodesia, South Africa. Received from Hon. E. Ross Townsend, Secretary for Agriculture, through Mr. W. A. Driver, Dinuba, Cal., June 30, 1906. (See Nos. 12810 and 12959, Inventory No. 11.)

18771. (Undetermined.) **Marula.**

18772. (Undetermined.) **Matundulaku.**

18773. CARICA PAPAYA. Papaw.

From Manila, P. I. Presented by Mr. W. S. Lyon, horticulturist, Bureau of Agriculture. Received June 29, 1906.

18774 to 18785.

From Mexico. Received through Mr. G. Onderdonk, July 5, 1906.

18774 to 18782. PRUNUS ARMENIACA. **Apricot.**

18774. *Onderdonk's No. 18.*

"From place of C. Ramirez, Lagos, Jalisco. Fruit yellow, light blush. sweet, freestone, circumference 4 inches."

18775. *Onderdonk's No. 19.*

"From place of Francisco Gomez Garcia, Lagos, Jalisco. Fruit white, 4½ inches in circumference."

18776. *Onderdonk's No. 20.*

"From place of Enrique Maupin, Aquascalientes. Fruit yellow, light blush, sweet, 5 inches in circumference."

18777. *Onderdonk's No. 21.*

18778. *Onderdonk's No. 22.*

18779. *Onderdonk's No. 23.*

18780. *Onderdonk's No. 24.*

"Nos. 18777 to 18780 are from Señor Maupin's orchard at Aquascalientes. They are all of the same general character, yellow with faint blush, fruit from 4 to 5 inches in circumference."

18781. *Onderdonk's No. 15.*

Nellie. (See No. 9844, Inventory No. 10.)

18782. *Onderdonk's No. 16.*

Dorah. (See No. 9845, Inventory No. 10.)

18774 to 18785—Continued.

18783. Amygdalus persica. **Peach.**

Procured by Mr. Oderdonk's son from El Cobre Mountain, near Guadalajara. "A very large, yellow, clingstone peach."

18784 and 18785. Malus malus. **Apple.**

18784.

Peron. From place of Mr. J. R. Silliman, Saltillo. (See No. 9014, Inventory No. 10.)

18785.

Procured by Mr. Onderdonk's son from El Cobre Mountain. "Very large, rich flavor, greenish color, yellowing slightly as it ripens. No better apple in Mexico."

18786 to 18800.

From La Paz, Bolivia. Presented by Señor M. V. Ballovian, Ministerio de Colonias y Agricultura. Received July 6, 1906.

18786 to 18798. Solanum tuberosum. **Potato.**

18786. *Phinu.*
18787. *Lugui.*
18788. *Pitiguilla.*
18789. *Chiarimilla.*
18790. *Khati.*
18791. *Monda.*
18792. *Socco.*
18793. *Ajahuira.*
18794. *Queni.*
18795. *Phureja.*
18796. *Koillu.*
18797. (Label missing.)
18798. *Ajahuira.*

The label for No. 18798, *Ajahuira*, is the same as that for No. 18793, and it is not known to which lot it properly belongs, as the consignment was mixed in transit. The tubers are not alike.

18799 and 18800. Oxalis tuberosa. **Oca.**

18799. *Rosada.*
18800. *Morada.*

18801. (Undetermined.)

From Piracicaba, Brazil. Presented by Dr. J. W. Hart, director of the Agricultural College. Received July 7, 1906.

Native name *Caja manga.* (Hart's No. 35.)

18802 to 18823.

From Erfurt, Germany. Received through Messrs. Haage and Schmidt, July 9, 1906.

18802. Medicago media. **Sand lucern.**

18803. Vicia calcarata.
18804. Vicia cordata.
18805. Vicia cornigera.
18806. Vicia cuspidata.
18807. Vicia disperma.
18808. Vicia ferruginea.
18809. Vicia gerardi.
18810. Vicia globosa.
18811. Vicia grandiflora.
18812. Vicia hybrida.
18813. Vicia macrocarpa.
18814. Vicia michauxii.
18815. Vicia narbonensis.
18816. Vicia onobrychioides.
18817. Vicia pannonica.
18818. Vicia peregrina.
18819. Vicia picta.
18820. Vicia pseudo-cracca.
18821. Vicia spuria.
18822. Vicia striata.
18823. Vicia tricolor.

18824 to 18826. ORYZA SATIVA. **Rice.**

From Persia. Presented by Mr. John Tyler, United States vice-consul-general. Teheran, Persia. Received July 6, 1906.

Three samples of unhulled rice from the region south of the Caspian Sea. These samples of rice were given to Mr. Tyler by a friend whose official title is "The Sepahdor" (Commander), who owns large areas where rice of the best sorts are grown. The samples received are of three kinds and from three separate districts, but no labels accompanied them to indicate which was which.

18824. Long slender grain, light hull.

18825. Long slender grain, light hull.

18826. Short flat grain, darker hull.

18827. MEDICAGO SATIVA. **Alfalfa.**

From Chicago, Ill. Received through the A. Dickinson Company, July 9, 1906.

18828. CARICA PAPAYA. **Papaw.**

From Columbia, Isle of Pines, West Indies. Presented by Dr. F. R. Ramsdell. Received July 10, 1906.

18829 and 18830. ANDROPOGON SORGHUM.

From Channing, Tex. Received through Mr. J. J. Edgerton, July 13, 1906.

18829. **Kafir corn.**

Black-Hulled White.

18830. **Milo.**

Dwarf.

18831 to 18834. CYNARA SCOLYMUS. **Artichoke.**

From Milan, Italy. Received through Fratelli Ingegnoli, July 16, 1906.

18831. *Grosso d' Italian.*
18832. *Violetto di Provenza.*
18833. *Sensa Spine di Venezia.*
18834. *Palla di Roma.*

18835 to 18912. FICUS CARICA. **Fig.**

From Niles, Cal. Received through the California Nursery Company at the Plant Introduction Garden, Chico, Cal., in March, 1906.

Nos. 18835 to 18898, inclusive, are from the Chiswick collection. A description of these varieties will be found in Bulletin No. 9, Division of Pomology, 1901.

18835. *De l' Archipel.*
18836. *Bontard.*
18837. *Grosse Marseilles.*
18838. *Peau dure.*
18839. *Negronne.*
18840. *Bourjassote noire.*
18841. *Poulette.*
18842. *Œil de Perdrix.*
18843. *Du Roi.*
18844. *Grosse Violette de Bordeaux.*
18845. *Datte.*
18846. *Monstrueuse.*
18847. *Bourjassote Grise.*
18848. *A' Bois Jaspee.*
18849. *Royal Vineyard.*
18850. *De Grasse.*
18851. *Euscaire Preto.*
18852. *Trois Recoltes.*
18853. *Monaco Bianco.*
18854. *Bondance Precoce.*
18855. *Trifer.*
18856. *Green Ischia.*
18857. *Hirta du Japon.*
18858. *St. Johns.*

18835 to 18912—Continued.

18859. *Vebra.*
18860. *Datte Quotidienne.*
18861. *Arbal.*
18862. *De Jerusalem.*
18863. *Nebian.*
18864. *Vigasotte Bianco.*
18865. *Grise Savantine bifere.*
18866. *Quarteria.*
18867. *Douro Vebra.*
18868. *Reculver.*
18869. *Gourand Rouge.*
18870. *D'Agen.*
18871. *Lampa.*
18872. *Large Black Douro.*
18873. *Adam.*
18874. *De Constantine.*
18875. *Biberæo.*
18876. *Grosse Verte.*
18877. *Violette Sepor.*
18878. *Dr. Hoggs Clare.*
18879. *Hardy Prolific.*
18880. *Figue d'Or.*
18881. *Recousse noire.*
18882. *Black Douro.*
18883. *Grassale.*
18884. *Martinique.*
18885. *Crave.*
18886. *White Ischia.*
18887. *Brown Turkey.*
18888. *Pastiliere.*
18889. *Negro Largo.*
18890. *De La Madeleine.*
18891. *Col de Signora Bianco.*
18892. *Doree Nobis.*
18893. *Pingo de Mel.*
18894. *Black Ischia.*
18895. *Toulousienne.*
18896. *Gouraud Noir.*
18897. *Doree.*
18898. *Brunswick.*
18899. *Gentile.*
18900. *White Adriatic.*
18901. *Pacific white.*
18902. *Vendome.*
18903. *Barbillonne.*
18904. *Figuires Blanch.*
18905. *Warren's Brown Turkey.*
18906. *Capri Milco.*
18907. *Trojano.*
18908. *Capri Solms No. 1.*
18909. *Capri Solms No. 2.*
18910. *Capri Solms No. 3.*
18911. *Capri Solms No. 4.*
18912. *Dauphine.*

18913. TRIFOLIUM PRATENSE. **Red clover.**

From Emilia, Italy. Presented by William G. Scarlett & Co., Baltimore, Md. Received in April, 1906.

18914. PINUS KORAIENSIS (?). **Pine.**

From Manchuria. Presented by the Yokohama Nursery Company, Yokohama, Japan. Received July 5, 1905.

Seed of a 5-needled pine obtained at the base of Heirai Mountain, Manchuria.

18915 to 18921. ORYZA SATIVA. **Rice.**

From Cairo, Egypt. Received through Mr. George P. Foaden, secretary of the Khedivial Agricultural Society, July 5, 1906.

18915. *Ein el Bent.*
18916. *Sina.*
18917. *Italien Ranghino.*
18918. *Fino.*
18919. *Agemi.*
18920. *Sultani.*
18921. *Japonais.*

18922 and 18923.

From Kashgar, Eastern Turkestan. Presented by Rev. P. J. P. Hendriks. Received July 20, 1906.

18922. HORDEUM VULGARE. **Barley.**

"A variety which is said to require only one month without frost. Grown in the mountain regions near Kashgar, Eastern Turkestan." (*Hendriks.*)

18923. RICINUS COMMUNIS. **Castor-oil plant.**

Seed of a medium-sized variety.

18924. MANGIFERA INDICA. **Mango.**

From Miami, Fla. Received through the Subtropical Laboratory and Garden, July 23, 1906.

Turpentine. Seed for growing stocks upon which to inarch standard varieties.

18925. ANONA CHERIMOLIA. **Cherimoyer.**

From Salta Province, Argentina. Presented by Mr. Ernest Nelson, of Sharon, Mass. Received July 13, 1906.

18926 to 18940. ANDROPOGON SORGHUM. **Sorghum.**

From Chillicothe, Tex. Grown in 1905 at the Government Farm, and distributed from same place.

18926. *Djougara balki.* Grown from Agrost. No. 1579.
18927. *Planter's Friend.* Grown from Agrost. No. 1604.
18928. *Amber.* Grown from Agrost. No. 1606.
18929. *Amber.* Grown from Agrost. No. 1658.
18930. *Planter's Friend.* Grown from Agrost. No. 1659.
18931. *Amber.* Grown from Agrost. No. 1747.
18932. *Black-seeded.* Grown from Agrost. No. 2114.
18933. *Edra.* Grown from S. P. I. No. 8815.
18934. *Dshugara Balcha.* Grown from S. P. I. No. 9796.
18935. *Dagdi Jowar.* Grown from S. P. I. No. 9856.
18936. *Djugara.* Grown from S. P. I. No. 10612.
18937. *White.* Grown from S. P. I. No. 13317.
18938. *Red.* Grown from S. P. I. No. 13318.
18939. *Gare.* Grown from S. P. I. No. 14504.
18940. *White of Rey Barelly.* Grown from S. P. I. No. 14635.

18941. LATHYRUS SATIVUS. **Bitter vetch.**

From Clarinda, Iowa. Received through the A. A. Berry Seed Company, July 27, 1906.

18942 to 19057.

From Mexico and southwestern United States. Collected by Mr. David Griffiths, of this Department, and forwarded to the Plant Introduction Garden, Chico, Cal., during the summer of 1905.

The numbers in parentheses are those of Mr. Griffiths.

18942. OPUNTIA sp. **Tuna.**

From El Paso, Tex. (8020.)

18942 to 19057—Continued.

18943. Opuntia sp. **Tuna.**

From El Paso, Tex. (8021.)

18944. Nopalea sp.

From San Mateo, Mexico. (8027.)

18945. Opuntia sp. **Tuna.**

Nopal cristilena. From Cardenas, Mexico. (8030.)

18946 to 19057. Opuntia sp. **Tuna.**

18946. From Cardenas, Mexico. (8031.)

18947. From Cardenas, Mexico. (8032.)

18948. From San Luis Potosi, Mexico. (8034.)

18949. From San Luis Potosi, Mexico. (8035.)

18950. *Nopal Cuijo.* From San Luis Potosi, Mexico. (8036)

18951. *Nopal ranchero.* From San Luis Potosi, Mexico. (8037.)

18952. *Nopal palmito.* From San Luis Potosi, Mexico. (8038.)

18953. From San Luis Potosi, Mexico. (8039.)

18954. *Nopal camueso.* From San Luis Potosi, Mexico. (8040.)

18955. From San Luis Potosi, Mexico. (8041.)

18956. From San Luis Potosi, Mexico. (8042.)

18957. *Nopal tapon.* From San Luis Potosi, Mexico. (8043.)

18958. *Nopal.* From San Luis Potosi, Mexico. (8044.)

18959. *Tuna castilla blanca.* From San Luis Potosi, Mexico. (8045.)

18960. *Nopal charol.* From San Luis Potosi, Mexico. (8046.)

18961. From San Luis Potosi, Mexico. (8047.)

18962. From San Luis Potosi, Mexico. (8048.)

18963. *Nopal jocoquillo.* From San Luis Potosi, Mexico. (8049.)

18964. From San Luis Potosi, Mexico. (8050.)

18965. From Alonzo, Mexico. (8053.)

18966. From Alonzo, Mexico. (8055.)

18967. From San Luis Potosi, Mexico. (8058.)

18968. *Nopal jarrillo.* From San Luis Potosi, Mexico. (8061.)

18969. From San Luis Potosi, Mexico. (8062.)

18970. From San Luis Potosi, Mexico. (8063.)

18971. From San Luis Potosi, Mexico. (8064.)

18972. *Nopal cardon blanco.* From Hepasote, Mexico. (8067.)

18973. *Nopal opalillo.* From Hepasote, Mexico. (8068.)

18974. *Tuna amarilla blanca.* From Hepasote, Mexico. (8069.)

18975. From Hepasote, Mexico. (8071.)

18976. From Hepasote, Mexico. (8072.)

18977 *Mameya.* From Hepasote, Mexico. (8073.)

18978. From Hepasote, Mexico. (8074.)

18979. *Nopal San Juanero.* From Hepasote, Mexico. (8075.)

18980. *Nopal loco.* From Hepasote, Mexico. (8076.)

18981. From Hepasote, Mexico. (8077.)

18942 to 19057—Continued.

18982. *Nopal blanco liso.* From Hacienda Los Campos, Mexico. (8079.)
18983. *Nopal durasnillo.* From Aguascalientes, Mexico. (8081.)
18984. *Nopal durasnillo.* From Aguascalientes, Mexico. (8082.)
18985. From Aguascalientes, Mexico. (8083.)
18986. *Nopal joconoxtle.* From Aguascalientes, Mexico. (8084.)
18987. *Nopal joconoxtle.* From Aguascalientes, Mexico. (8086.)
18988. From Aguascalientes, Mexico. (8087.)
18989. From Aguascalientes, Mexico. (8088.)
18990. *Nopal joconoxtle.* From Aguascalientes, Mexico. (8089.)
18991. From Aguascalientes, Mexico. (8090.)
18992. From Aguascalientes, Mexico. (8091.)
18993. *Nopal tapon.* From Aguascalientes, Mexico. (8092.)
18994. *Spineless.* From Aguascalientes, Mexico. (8094.)
18995. From Aguascalientes, Mexico. (8101.)
18996. From Encarnacion, Mexico. (8102.)
18997. *Nopal liso.* From Encarnacion, Mexico. (8103.)
18998. From Los Sauses, Mexico. (8104.)
18999. *Nopal colorado.* From Los Sauses, Mexico. (8105.)
19000. From Los Sauses, Mexico. (8106.)
19001. From Los Sauses, Mexico. (8107.)
19002. From Los Sauses, Mexico. (8108.)
19003. *Cascaron.* From Los Sauses, Mexico. (8109.)
19004. *Durasnillo.* From Los Sauses, Mexico. (8110.)
19005. From Los Sauses, Mexico. (8111.)
19006. From Dublan, Mexico. (8113.)
19007. From Dublan, Mexico. (8114.)
19008. From Dublan, Mexico. (8114a.)
19009. From Dublan, Mexico. (8115.)
19010. From Dublan, Mexico. (8119.)
19011. From Dublan, Mexico. (8121.)
19012. From Guadalajara, Mexico. (8125.)
19013. From Guadalajara, Mexico. (8126.)
19014. From Guadalajara, Mexico. (8127.)
19015. From Guadalajara, Mexico. (8128.)
19016. From Guadalajara, Mexico. (8130.)
19017. From Aguascalientes, Mexico. (8138.)
19018. *Nopal camueso.* From Zacatecas, Mexico. (8140.)
19019. *Pachon.* From Zacatecas, Mexico. (8141.)
19020. *Nopal naranjado.* From Zacatecas, Mexico. (8142.)
19021. *Nopal durasnillo.* From Gutierrez, Mexico. (8143.)
19022. From Zacatecas, Mexico. (8145.)
19023. *Nopal blanco.* From Zacatecas, Mexico. (8146.)

18942 to 19057—Continued.

19024. From Zacatecas, Mexico. (8147.)
19025 From Zacatecas, Mexico. (8148.)
19026. From Zacatecas, Mexico. (8149.)
19027. From Torreon, Mexico. (8151.)
19028. From Torreon, Mexico. (8152.)
19029. From El Paso, Tex. (8153.)
19030. From Tucson, Ariz. (8154.)
19031. From Celero Mountains, Ariz. (8157.)
19032. From Santa Rita Mountains, Ariz. (8158.)
19033. From Santa Rita Mountains, Ariz. (8159.)
19034. From Santa Rita Mountains, Ariz. (8160.)
19035. From Santa Rita Mountains, Ariz. (8161.)
19036. From Santa Rita Mountains, Ariz. (8162.)
19037. From Santa Rita Mountains, Ariz. (8163.)
19038. From Santa Rita Mountains, Ariz. (8164.)
19039. From Santa Rita Mountains, Ariz. (8165.)
19040. From Santa Rita Mountains, Ariz. (8166.)
19041. From Santa Rita Mountains, Ariz. (8167.)
19042. From Santa Rita Mountains, Ariz. (8168.)
19043. From Santa Rita Mountains, Ariz. (8169.)
19044. From Santa Rita Mountains, Ariz. (8170.)
19045. From Santa Rita Mountains, Ariz. (8171.)
19046. From Santa Rita Mountains, Ariz. (8172.)
19047. From San Antonio, Tex. (8174.)
19048. From San Antonio, Tex. (8175.)
19049. From San Antonio, Tex. (8176.)
19050. From Mexico.
19051. From Mexico.
19052. From Mexico.
19053. From Mexico. (8076.)
19054. From San Antonio, Tex. (8182.)
19055. From T. S. Brandegee (No. 1), San Diego, Cal.
19056. From T. S. Brandegee (No. 2), San Diego, Cal.
19057. From T. S. Brandegee (No. 3), San Diego, Cal.

THE PHILADELPHIA
FEB 19 1908

INDEX OF COMMON AND SCIENTIFIC NAMES.

Aberia caffra, 18667.
Abroma augusta, 18475.
Abutilon avicennae, 17529, 18450.
Acacia sp., 18549.
    farnesiana, 18508.
Acer sp., 17897, 17898.
    mono, 18578.
Actinidia sp., 18285.
    chinensis, 18535, 18584.
Actinorhytis calapparia, 17140.
Aegilops macrochaeta, 17792.
    macrura, 17794.
    ovata, 17795.
    squarrosa, 17796.
    triaristata, 17797.
    triuncialis, 17798.
Aesculus chinensis, 17736.
Agave lecheguilla, 17715.
    rigida sisalana, 17437, 17716, 18244, 18638.
Agropyron acutum, 17799.
    cristatum, 17826.
    elymoides, 17827.
    muricatum, 17800.
    occidentale, 17699.
    pungens, 16895.
    repens, 17824, 17828, 17829, 17831.
    tenerum, 17489.
Agrostis alba, 16829 to 16832, 17837.
    canina, 18413.
    stolonifera, 16828, 17963.
Albizzia lebbek, 18509.
Alfalfa, Arabian, 18627, 18628.
    Jet, 18627, 18628.
    (Mexico), 17163.
    Provence, 18418, 18664.
    (Spain), 17992.
    Turkestan, 17281, 18247, 18391, 18425, 18751.
    (Utah), 17449.
        See also *Medicago sativa.*
Almond. (Baluchistan), 18238.
    (Italy), 17106 to 17130.
        See also *Amygdalus communis.*
Alocasia grandis, 18756.
    indica, 17103, 18383, 18384, 18758.
    longiloba, 18757.
    lowii, 18755.
    macrorhiza, 17236, 18760.
    singaporensis, 18759.
Alopecurus brachystachyus, 16800.
    pratensis, 16849. 18414, 18484.
    ventricosus, 17063.
Alsike. See *Trifolium hybridum.*
Althaea rosea, 18739.
Altingia chinensis, 18569.
Amatungulu. See *Carissa arduina.*
Amomum melegueta, 16945.
Amorphophallus campanulatus, 17101. 18387.
    prainii, 18752.
    rex, 18753.
    sativus, 18386, 18754.
Ampelopsis sp., 17938, 17939, 17940, 17942, 18280, 18281, 18284, 18292, 18293.
Amygdalus communis, 17106 to 17130, 18238,
    davidiana, 17729 to 17731, 18595, 18706.
    persica, 16919, 17167, 17470, 17728, 17902, 17903, 18234, 18239, 18262, 18588 to 18594, 18783.
        laevis, 18235.
Andropogon sp., 17182.
    affinis, 17183.
    australis, 18357.
    bombycinus, 17035.
    colorans, 18165 to 18167.
    cymbarius, 18463.
    halepensis, 16908.
    intermedius, 18347.
    pertusus, 16907.
    sericeus, 17184, 18130, 18346.
    sorghum, 16854 to 16861, 17475, 17490, 17513, 17524, 17535 to 17691, 17695, 17702, 17756, 17757, 17833, 17834, 17920 to 17923, 17984, 18160 to 18198, 18203, 18309, 18326, 18343 to 18345, 18388, 18389, 18411, 18501 to 18504, 18518, 18610 to 18614, 18625, 18626, 18633, 18684, 18829, 18830, 18926 to 18940.
Anona sp., 18715, 18766, 18767.
    cherimolia, 18925.
    muricata, 18737.
    reticulata, 18736.
Anthistiria ciliata, 18348.
Anthriscus sylvestris, 16952.
Anthyllis vulneraria, 17076.
Antidesma bunius, 18393.
Apple (Mexico), 18784, 18785.
        See also *Malus malus.*

Apricot (China), 16917, 17152 to 17154, 17844, 17845, 18260, 18261, 18290.
(Mexico), 18774 to 18782.
See also *Prunus armeniaca*.
Arachis hypogaea, 16940, 16941, 16943, 16944, 17055 to 17057, 17530 to 17533, 17710 to 17712, 17960, 17988, 18295, 18296, 18311 to 18315, 18334 to 18337, 18523, 18524, 18675, 18676.
Aralia cordata, 17235.
Araucaria brasiliana, 18768.
Argemone mexicana, 18719.
Aristolochia sp., 17061, 17846.
Arrhenatherum avenaceum, 17801.
bulbosum, 17802.
elatius, 16949, 18415, 18485.
Artemisia annua, 17950.
Artichoke Globe, or Paris, 16869.
(Italy), 18831 to 18834.
Large Green, 18703.
Purple Globe, 18702.
See also *Cynara scolymus*.
Asparagus sp., 18662.
acutifolius, 17981, 18225, 18464, 18465.
crispus, 18668.
medeoloides, 18466, 18467.
myriocladus, 18764.
sarmentosus, 18669.
scaber, 18478.
sprengeri, 18670.
Astragalus sp., 18438.
falcatus, 16985, 17077.
Astrebla elymoides, 17037, 17185, 17186.
pectinata, 17036, 17187, 17188.
triticoides, 17189, 17190.
Atropa belladonna, 16815.
Avena argentea, 17803.
atropurpurea, 17804.
brevis, 16892.
decora, 16799.
flavescens, 16986.
orientalis, 17805.
pubescens, 16951.
sativa, 16863 to 16865, 17148, 17450 to 18452, 17464, 17526, 17527, 17694, 17700, 17701, 17720, 18229, 18245, 18246.
diffusa, 16893, 16894.
Avocado, Grant, 18731.
Johnstone, 18729.
Largo, 18730.
Mitchell, 18120.
Trapp, 16871.
See also *Persea gratissima*.

Bahama Islands, seeds and plants from, 18727 to 18749.
Barley, Beardless, 17525.
(China), 18454, 18458.
Hanna, 17147, 18666.
Hannchen, 18540.
Hull-less, 18458.
Primus, 18541.
Prinsess, 18542.
Tennessee Winter, 16862, 17100.
Barley, (Turkestan), 18922.
See also *Hordeum* spp.
Basella alba, 18740.
Bauhinia krugii, 17955.
tomentosa, 18685.
Bean, Adzuki. See *Phaseolus angularis*.
Broad, 17164, 17853, 18241, 18340, 18434.
Haricot (China), 17858, 17859.
Horse, 17860, 18137, 18142, 18143.
Hyacinth. See *Dolichos lab-lab*.
Knife. See *Canavalia ensiformis*.
Mung. See *Phaseolus max* and *P. radiatus*.
Newman, 17096.
Soy. See Soy bean.
See also *Phaseolus* spp.
Beet, Sugar, 17509, 17968 to 17980, 18119, 18233, 18332.
See also *Beta vulgaris*.
Benincasa cerifera, 17967.
Beta vulgaris, 17509, 17968 to 17980, 18119, 18233, 18332.
Blackberry, Himalaya, 17473.
"Bonavis" (Bahamas), 18746, 18747.
Borecole, improved branching, 17078.
Bouteloua curtipendula, 17051.
oligostachya, 17052.
Brachypodium, japonicum, 18358, 18359.
pinnatum, 16953, 17823.
sylvaticum, 16954.
Brassica sp., 18441, 18442, 18452.
chinensis, 17867.
oleracea, 17078, 17079, 17864 to 17869, 17895, 17953.
pe-tsai, 17864, 17865, 17866, 17868, 17869, 17953, 18606.
rapa, 18401.
Brazil, seeds from, 18704, 18766 to 18770, 18801.
Bromus sp., 16822.
brachystachys, 16896.
erectus, 18416.
inermis, 16823 to 16825, 16955, 18491.
mollis, 17064.
pannonicus, 16798.
pratensis, 16826, 16987.
racemosus, 17065.
rubens, 16821.
sterilis, 16897.
sylvaticus, 17066.
unioloides, 16827, 18360.
vernalis, 16797.
Buchu. See *Diosma crenata*.
Buckwheat. See *Fagopyrum esculentum*.
Bur clover. See *Medicago denticulata*.

Cabbage (China), 17864 to 17869, 17895, 17953, 18606.
See also *Brassica* spp.
Calathea sp., 16934.
crotalifera, 16933.
oppenheimiana, 16396.
ornata sanderiana, 16935.
princeps, 16932.
vittata, 16937.

Calla. See *Richardia* spp.
Camphor. See *Cinnamomum camphora.*
Canavalia sp., 17957.
ensiformis, 18321, 18329.
Canna sp., 18424.
flaccida, 17961.
indica, 18300.
iridiflora, 18301.
Cannabis sativa, 17528, 18451, 18632.
Capsicum fastigiatum, 16817, 16818.
Carex stenophylla, 17466.
Carica papaya, 18400, 18773, 18828.
Carissa arduina, 18539, 18671.
Carrot (China), 17754, 17870 to 17872.
See also *Daucus carota.*
Cassia mimosoides, 18361.
Castanea sativa, 17876, 17877, 17896, 18341.
Castor oil plant. See *Ricinus communis.*
Casuarina glauca, 18686.
stricta, 18687.
Catalpa bungei, 16914, 17740, 18267.
Caterpillars. See *Scorpiurus* spp.
Catesbaea spinosa, 18741.
Catnip. See *Nepeta cataria.*
Celastrus flagellaris, 17918.
paniculatus, 17873, 17874.
"Celery," Silver King Hardy, 18469.
Celtis sp., 17168, 17857.
Cenchrus australis, 17028.
Cephalaria tatarica, 16900.
Cereus, sp., 18500.
Ceropegia fusca, 16868.
Chaetochloa aurea, 17047, 17233.
glauca, 16904, 18875.
italica, 17899 to 17901, 18152 to 18155, 18505, 18621, 18622.
pachystachya, 18376.
viridis, 18377.
gigantea, 18378.
Chamaecyparis lawsoniana, 17990.
Chayote. See *Sechium edule.*
Chenopodium quinoa, 18236, 18237, 18536, 18537, 18689 to 18691.
Cherry (China), 16918, 17732, 17733, 18587.
Chestnut (China), 17876, 17877,. 17896.
See also *Castanea sativa.*
Chillies, Japanese. See *Capsicum fastigiatum.*
Chimonanthus fragrans, 18573.
China jute. See *Abutilon avicennae.*
Chloris acicularis, 17191.
divaricata, 18349.
truncata, 17039, 17193, 17194, 18350.
ventricosa, 17040, 17192.
virgata, 17248.
Chrysophyllum sp., 18704.
cainito, 17093.
Chrysopogon gryllus, 17041, 17195.
parviflora, 18351.
Cinnamomum camphora, 17105.
Citrange, Morton, 16872.
Citrullus vulgaris, 18308.
Citrus aurantium, 17151, 17505 to 17507.
australasica, 18550.
decumana, 18440, 18727, 18728.
medica, 18439.
torosa, 18468.
trifoliata × *aurantium*, 16872.
Clematis sp., 17959.
Clover, Limoru, 18461.
Lodino, 18692.
See also *Trifolium* spp.
Cobaea scandens, 18716.
Coffea arabica, 17713, 17714.
Coix lacryma-jobi, 18362.
Colocasia sp., 17985, 17987, 18320.
antiquorum, 17237 to 17244.
esculenta, 17102.
neo-guineensis, 16938.
Corchorus sp., 18453.
capsularis, 18435.
Corn (Bahamas), 18742 to 18744.
(China), 17880, 17881.
Crosby sweet, 17516 to 17518.
Dent (Mexico), 18531 to 18534.
Flint, 18426.
Giant Gourd, 17692.
Golden Malakhov, 18200, 18201.
(Hungary), 18679, 18680.
(Peru), 18302.
Yellow Flint, 17523.
See also *Zea mays.*
Coronilla scorpioides, 17068.
varia, 16956.
Corylus sp., 17169, 17890.
Costa Rica, seed from, 18708 to 18725.
Cotton. See *Gossypium* spp.
Cowpea, Abyssinian, 17492, 17493.
(Arkansas Experiment Station), 17409, 17421, 17429.
Barbati, 17380, 17382.
Bhadela, 17378, 17379.
black and white mottled, 17327.
× Blackeye, 17410.
Blackeye, 18472.
(White Giant), 17366.
Blackeyed Lady, 17420.
Brown Coffee, 17404.
eye, 17341.
Crowder, 17348, 17370, 17398.
Calico, 17413.
California Blackeye, 17338.
Chauli, 17376.
(China), 17849, 17855, 17856, 18617.
Chinese Browneye, 17329.
Red, 17328.
Whippoorwill, 17330.
Choli, 17377, 17381.
Clay, 17340, 17351, 17358, 17383, 17391, 17395, 18519.
Coffee, 17414.
Conch, 17415.
Cream, 17693.
Delicious Large Lady, 17373.
Down's Early Ripener, 17331.

Cowpea, Early Black, 17336, 17337, 17343.
    Extra Early Blackeye, 17335.
        × Black, 17417, 17424.
    (Greece), 17333.
    Greyeye, 17390.
    Holstein, 17418.
    (hybrid), 17384, 17385, 17389, 17400.
    Iron, 17367, 17396, 17397, 17430, 17431, 17433 to 17436, 17697.
        Mountain, 17423.
    Jhunga, 17375.
    Lady, 17359.
        Finger, 17388.
    Large Blackeye, 17346, 17355, 17362.
    Little Iron, 17419.
    Michigan Favorite, 17402, 17406, 17432.
    (Morioka, Japan), 17332.
    Mount Olive, 17426.
    New Era, 17403, 17411, 18522.
    Old Man, 17354.
    Pinkish-Tan, 17405.
    Powell's Early Prolific, 17392.
    Red Carolina, 17519.
        Crowder, 17393, 17428.
        Mauve, 17369.
        Ripper, 17350, 17361, 18520.
        Whippoorwill, 17374, 17416.
        Yellow-Hull, 17365.
    Rice, Long Lady, 17401.
    Sixty-Day, 17386, 17387.
    Small Whippoorwill Crowder, 17371.
    Southdown Mottled, 17339.
    Speckled Java, 17412.
    Sport, 17427.
    Steckler's Improved, 17405, 17407.
    Taylor, 17342, 17364, 17368.
    (unclassified), 16812, 17334, 17347, 17357, 17360.
    Unknown, 17344, 17353, 17356, 18473.
    Warren's Extra Early, 17352.
    Warren's Extra Early × Sugar Crowder, 17422.
        New Hybrid, 17345.
    Watson's Hybrid, 17425.
    Whippoorwill, 17349, 18521.
        × Lady, 17408.
        Saddleback, 17409.
    White Crowder × Whippoorwill, 17363.
    Whittle, 17399.
    Wight Black Crowder, 17372.
    Yellow Sugar Crowder, 17394.
    See also *Vigna unguiculata*.
Crambe maritima, 18701.
Crataegus sp., 17170, 17472, 17751.
    pinnatifida, 17171, 17739, 17882, 17883.
Crotalaria juncea, 18330.
Cucumber (Persia), 18307.
    See also *Cucumis sativus*.
Cucumis melo, 17478, 17480 to 17482, 17522, 18232, 18303 to 18306, 18462, 18507.
    sativus, 18307.
Cucurbita maxima, 18398, 18405, 18406.
    melanosperma, 18328, 18395.
    pepo, 18121, 18397.
Custard-apple. See *Anona reticulata*.
Cyamopsis tetragonoloba, 18641 to 18651.
Cydonia japonica, 17954, 18601.
Cynara scolymus, 16869, 18702, 18703, 18831 to 18834.
Cyperus esculentus, 18390.
Cytisus proliferus albus, 16957.
    scoparius, 17080.

Dactylis altaica, 17806.
    glaucescens, 17807.
    glomerata, 16850, 16958, 16988, 18492.
    hispanica, 17808.
Danthonia carphoides, 17197, 17198.
    nervosa, 17199, 17200.
    penicillata, 17201 to 17202, 17204 to 17207, 17209, 17210.
        villosa, 17208.
    semiannularis, 17203, 17211, 17494.
Daphne sp., 18572.
Date, Manakher, 17993.
    Tafilalt, 18630.
    Timjoohert, 18693 to 18698.
    See also *Phoenix dactylifera*.
Daucus carota, 17754, 17870 to 17872.
Desmodium gardneri, 18363.
Deyeuxia forsteri, 17196.
Dianthus squarrosus, 17832.
Digitalis purpurea, 16813.
Dioscorea aculeata, 18316, 18659 to 18661.
    alata, 18657, 18658.
    bulbifera, 18656.
    pentaphylla, 18655.
    trifida, 16866, 18317, 18318, 18652 to 18654.
Diosma crenata, 18672.
Diospyros sp., 16870, 18598, 18599.
    kaki, 16910, 16912, 16913, 16921, 17172, 17704 to 17707, 18596, 18597.
    lotus, 17173, 17905 to 17907, 18266.
    virginiana, 17145.
Diplachne dubia, 17234.
    fusca, 17212, 17213, 18125.
    peacockii, 17214, 18126.
Dolichos atropurpureus, 17534.
    lablab, 17884, 17885, 18448, 18746, 18747.
    lubia, 18726.
Echinacea helianthi, 18423.
Eggplant. See *Solanum melongena*.
Einkorn. See *Triticum monococcum*.

Elaeagnus sp., 17479, 17886, 18568.
  hyb., 18199.
Eleusine aegyptiaca, 16906, 17215, 18124.
  coracana, 17072 to 17075, 18364, 18512 to 18517, 18557 to 18560.
Elymus virginicus submuticus, 17131.
Emmer. See *Triticum dicoccum*.
Eragrostis sp., 17216.
  abyssinica, 17094, 17095.
  brownei, 17217, 18352.
  ferruginea, 18365.
  leptostachya, 17218.
  pilosa, 17219, 18123.
Eriochloa polystachya, 17220.
  punctata, 18353.
  villosa, 18366.
Erodium absinthoides, 17758.
  cheilanthifolium, 17759.
  chelidonifolium, 17760.
  cygnorum, 17245.
  gruinum, 16890, 17760a.
  hymenodes, 17761.
  malachoides, 16891.
  manescavi, 17762.
  pelargonifolium, 17763.
  semenovii, 17764.
  trichomanifolium, 17765.
  verbenaefolium, 17766.
Ervum lens, 17165.
Euchlaena mexicana, 16905.
Eugenia punicifolia, 17956.
Euonymus sp., 18278, 18286, 18567.
  japonicus, 18566.
Eutrema wasabi, 18333.

Fagopyrum esculentum, 17863.
Fatsia horrida, 17965.
Fenugreek. See *Trigonella foenum-graecum*.
Festuca arundinacea, 16989.
  carpathica, 16801.
  dumetorum, 16959, 17081.
  duriuscula, 16990.
  elatior, 16802, 16960, 16991, 17838, 18417.
  halleri, 18483.
  heterophylla, 16961, 16992, 17082.
  ovina, 16962, 16993, 17083.
  pratensis, 16848, 16963, 16994, 17059, 18487.
  pumila, 18490.
  rubra, 16964, 16995, 17084.
  tenuifolia, 16965, 16996, 17085.
  violacea, 18481.
Ficus benjamina, 18734.
  carica, 18835 to 18912.
  sycomorus, 18408.
Fig, Chiswick collection, 18835 to 18898.
Foxglove, purple. See *Digitalis purpurea*.
Fraxinus sp., 16922.
  longicuspis, 17748.
  ornus, 18399.

Galega biloba, 17767.
  persica, 17768.
Garcinia mangostana, 17146, 17514, 18479.
  morella, 17141, 17995.
  xanthochymus, 18765.
Gavilana, 18714.
Gleditsia sp., 17888, 17889, 18579.
Glyceria nemoralis, 16804.
Glycine hispida, 17251 to 17280, 17520, 17852, 17857, 17861, 17862, 18227, 18258, 18259, 18459, 18460, 18619, 18707.
Gossypium sp., 18623, 18721.
Grape, (Afghanistan), 18407.
  (China), 16927, 17155 to 17161 17467, 17468, 17755, 18602.
  Kapadjulari, 17718, 17719.
  Mustang. See *Vitis munsoniana*.
  Valandova, 18392.
  See also *Vitis* spp.
Grass, bluestem. See *Andropogon* spp.
  blue grama. See *Bouteloua oligostachya*.
  brome. See *Bromus* spp.
  Canadian blue. See *Poa compressa*.
  canary. See *Phalaris canariensis*.
  cane. See *Diplachne dubia*.
  cotton. See *Panicum leucophaeum*.
  creeping bent. See *Agrostis stolonifera*.
    soft. See *Holcus mollis*.
  downy oat. See *Avena pubescens*.
  early spring. See *Eriochloa polystachya*.
  English rye. See *Lolium perenne*.
  esparto. See *Stipa tenacissima*.
  Italian rye. See *Lolium italicum*.
  Kentucky bluegrass. See *Poa pratensis*.
  meadow foxtail. See *Alopecurus pratensis*.
    soft. See *Holcus lanatus*.
  Mitchell. See *Astrebla pectinata*.
  Mulga. See *Neurachne mitchelliana*.
  New Zealand meadow rice. See *Microlaena stipoides*.
  orchard. See *Dactylis glomerata*.
  pappus. See *Pappophorum commune*.
  para. See *Panicum molle*.
  perennial rye. See *Lolium perenne*.
  reed canary. See *Phalaris arundinacea*.
  rescue. See *Bromus unioloides*.
  Rhodes. See *Chloris virgata*.
  rough-stalked meadow. See *Poa trivialis*.
  slender wheat. See *Agropyron tenerum*.
  smooth brome. See *Bromus inermis*.
  star, umbrella, or windmill. See *Chloris* spp.
  sugar. See *Pollinia fulva*.
  tall grama. See *Bouteloua curtipendula*.
    meadow oat. See *Arrhenatherum elatius*.
  Vandyke. See *Panicum flavidum*.
  velvet. See *Holcus lanatus*.
  wallaby. See *Danthonia semiannularis*.

Grass, weeping love. See *Eragrostis pilosa.*
Ground cherry (Turkestan), 17477.
Guar. See *Cyamopsis tetragonoloba.*
Guava (São Paulo), 18769, 18770.
  See also *Psidium guajava.*
Gymnocladus chinensis, 18432, 18433.

Harpephyllum caffrum, 18474.
Haw, hawthorn, or thorn. See *Crataegus* spp.
Hedysarum coronarium, 16852.
  obscurum, 18496.
  sibiricum, 18339.
Helianthus annuus, 17925.
Hemp (Manchuria), 17528, 18632.
  See also *Cannabis sativa.*
Hibiscus manihot, 18580.
  rosa-sinensis, 18732.
  syriacus, 18574, 18575.
Hierochloe borealis, 17809.
Holcus argenteus, 17810.
  lanatus, 18367.
  mollis, 16966.
Hop, Bohemian, 18471.
  Semsch, 18299.
  See also *Humulus lupulus.*
Hordeum aegiceras, 16898.
  distichum erectum, 18541.
    nutans, 17147, 18540, 18542, 18666.
  vulgare, 16862, 17100, 17525, 18454, 18458, 18922.
  zeocriton, 16899.
Horse-radish, Japanese. See *Eutrema wasabi.*
Hosackia purshiana, 18226.
Humulus sp., 17891.
  lupulus, 18299, 18471.

Indian tobacco. See *Lobelia inflata.*
Indigofera tinctoria, 18368.
Ipomoea sp., 17835, 17836.
  batatas, 18297, 18298, 18402, 18631.
Ischaemum pectinatum, 18354.

Japan clover. See *Lespedeza striata.*
Jasminum nudiflorum, 18270.
Juglans hyb., 17929.
  regia, 17745 to 17747, 17943 to 17946, 18256, 18257, 18263, 18603, 18604.
Jujube. See *Zizyphus sativa.*
Juncus sp., 18429, 18430.
Juniperus chinensis, 17893, 18577.

"Kaba," 18431.
Kafir corn, 17475, 17566 to 17569, 17571, 17572, 18344, 18829.
Kale, thousand-headed, 17079.
Kickxia elastica, 17498.
Koelreuteria paniculata, 17894, 18277.

Lathyrus annuus, 18147.
  armitageanus, 17769.
  articulatus, 18149.
  clymenum, 18146.
Lathyrus cruikshankii, 17770.
  gorgoni, 17771.
  heterophyllus, 17497, 18158.
  hirsutus, 16998.
  latifolius, 17772.
  nissolia, 17773.
  ochrus, 16882, 18148.
  odoratus, 17774.
  pyrenaicus, 17775.
  rotundifolius, 17776.
  sativus, 17484, 18941.
  sibthorpii, 17777.
  tingitanus, 18145.
    uniflorus, 18144.
Lemon (China), 18439.
Lens nigricans, 18150.
Lentil. See *Ervum lens.*
Lespedeza buergeri, 18369.
  striata, 18370.
Levisticum officinale, 18469.
Ligusticum mutellina, 18489.
Lilium harrisii, 18538.
  philippinense, 17138, 18324.
Lobelia inflata, 16814.
Lolium italicum, 16845 to 16847, 18000.
  perenne, 16837 to 16844.
Lotus corniculatus japonicus, 18371.
  villosus, 17086.
Lucerne, sand. See *Medicago media.*
  See also *Medicago sativa.*
Luzula albida, 16997.
Lycium sp., 18271, 18581.
Lysichitum camtschatcense, 17966.

Macadamia ternifolia, 18382.
Malus spp., 17741, 17887.
  malus, 17069, 18600, 18784, 18785.
Mangifera indica, 18924.
Maranta kegeljani, 16931.
  leuconeura kerchoviana, 16939.
Marula, 18771.
Matundulaku, 18772.
Medicago sp., 18608.
  apiculata, 16873.
  decandollii, 17778.
  echinus, 16874.
  elegans, 17779.
  intertexta, 17780.
  media, 17087, 18470, 18802.
  murex, 16875.
  orbicularis, 16876, 17781.
  sativa, 17163, 17281, 17449, 17476, 17698, 17992, 18391, 18418, 18425, 18627 to 18629, 18664, 18677, 18678, 18751, 18827.
  scutellata, 16877, 17782.
  terebellum, 16878.
  tribuloides, 16879.
  tuberculata, 17783.
Melica ciliata, 16967.
  coerulea, 16968.
Melilotus alba, 16969, 17491, 18699.
  altissima, 17000.
  coerulea, 17067.
  leucantha, 17784.
  officinalis 17001.

Melilotus parviflora, 17002.
  segetalis, 17003.
  sulcata 17004.
Melon, Ecuador. See *Cucurbita melanosperma*.
Meyer, F. N., seeds and plants secured by, 16909 to 16927, 17152 to 17162, 17167 to 17181, 17466 to 17470, 17723 to 17755, 17842 to 17954, 17959, 18256 to 18293, 18429 to 18458, 18561 to 18626, 18662, 18706.
Microlaena stipoides, 17495.
Millet, Australian. See *Panicum decompositum*.
  broom-corn. See *Panicum miliaceum*.
  Italian. See *Chaetochloa italica*.
  Pearl. See *Pennisetum spicatum*.
   See also *Chaetochloa* spp. and *Panicum* spp.
Milo. See Sorghum.
Miscanthus condensatus, 17962.
  sinensis, 18372.
Morus alba, 16920, 16923, 18275, 18561 to 18563.
Mucuna sp., 18717.
Musa sapientum, 18525 to 18529.
Muskmelon. (Colombia), 18462.
  (India), 18507.
  (Persia), 18303 to 18306.
  Winter, 17478, 17480 to 17482, 17522, 18232.
   See also *Cucumis melo*.
Mussaenda frondosa, 17708.

Nelumbo nucifera alba, 18446.
  rosea, 18447.
Nepeta cataria, 16816.
Nephelium lappaceum, 17515.
Neurachne mitchelliana, 17221.
Nicotiana sp., 17927.
  alata persica, 17501.
  rustica brasilia, 17503, 17504.
   texana, 17502.
  sanderae, 17246, 17247, 17982, 17983.
  tabacum, 17465, 17928, 18682.
   fruticosa, 17499, 17500.
  tomentosa, 17989.
Nopal. See *Opuntia* sp.
Nopalea sp., 18944.

Oak, Truffle. See *Quercus ilex* and *Q. pubescens*.
  See also *Quercus* spp.
Oat, Appler Rustproof, 17450, 17452, 17464, 17700, 18229.
  Burt, 16865, 17451, 17701, 18230.
  Kherson, 17148.
  Sixty-Day, 16863, 17527, 17694, 17720.
  Snoma, 16864.
  (Sweden), 18245, 18246.
  Swedish Select, 17526.
   See also *Avena sativa*.
Oca. See *Oxalis tuberosa*.
Onobrychis caput-galli, 16881, 17785.
  crista-galli, 16880, 17786.
  onobrychis, 18639, 18640.
Opuntia sp., 18673, 18942, 18943, 18945 to 19057.
Orange (Algiers), 17507.
  (China), 17151, 17505, 17506.
   See also *Citrus aurantium*.
Oreodoxa regia, 17060.
Ornithopus sativus, 17709, 17839.
Oryza sativa, 16807, 16980 to 16984, 17135 to 17137, 17144, 17914 to 17917, 18615, 18616, 18824 to 18826, 18915 to 18921.
Oxalis ortgiesi, 16853.
  tuberosa, 18799, 18800.
Oxytropis campestris, 18493, 18495.

Pachyrhizus angulatus, 17958, 18331.
Palm (Philippines), 17140.
Panicularia americana, 16833.
Panicum sp., 17249.
  arachyrachus, 17222.
  decompositum, 17042, 17223, 18129, 18355.
  divaricatissimum, 18356.
  flavidum, 17224, 17225, 18127.
  laevifolium, 17071, 18705.
  leucophaeum, 17226.
  miliaceum, 17099, 18443, 18477, 18620.
  molle, 16809.
  prolutum, 17043, 17227, 17228, 18128.
  trypheron, 16902.
Papaver somniferum, 16819, 16820, 18681.
Papaw. See *Carica* sp.
Pappophorum commune, 17231, 17232.
  nigricans, 17721.
Paspalum brevifolium, 17044.
  dilatatum, 16903.
  stoloniferum, 16970.
  thunbergii, 18373.
Passiflora sp., 18428.
  quadrangularis 17521.
   variegata, 17143.
  racemosa, 17142.
Pea, Blackeye Marrowfat, 17486.
  blue Prussian, 17487.
  (China), 18455.
  field. See *Pisum arvense*.
  garden. See *Pisum sativum*.
  golden Vine, 17483.
  grass, 17484.
  wax-pod, 18157.
  White Marrowfat, 17485.
Peach (Baluchistan), 18239.
  (China), 16919, 17167, 17470, 17728, 17902, 17903, 18262, 18588 to 18595.
  (Mexico), 18783.
  Quetta, 18234.
   See also *Amygdalus persica*.
Peanut (Bolivia), 17988.
  (Brazil), 16941.
  (Ceylon), 18295, 18296, 18311 to 18315.

Peanut (East Africa), 17530 to 17533, 17960, 18675, 18676.
  (Egypt), 16940.
  (for foreign exchange), 18334 to 18337.
  (India), 18523, 18524.
  (Japan), 16943, 17710 to 17712.
  (Java), 17055 to 17057.
  (Spain), 16944.
  See also *Arachis hypogaea.*
Pear (China), 16911, 16916, 16924, 17177, 17178, 17723 to 17726.
  ornamental (China), 17176, 17727.
Peltandra sagittaefolia, 18325.
Pennisetum caudatum, 17811.
  compressum, 17045.
  japonicum, 18374.
  latifolium, 17812.
Perilla ocymoides, 17904, 18445.
Persea gratissima, 16871, 18120, 18729 to 18731.
Persimmon (China), 16910, 16912, 16913, 16914, 16921, 17172, 17173, 17905 to 17907, 18266, 18596 to 18599.
  common. See *Diospyros virginiana.*
  Japanese. See *Diospyros kaki.*
Phaca frigida, 18494.
Phalaris arundinacea, 16971, 17005.
  canariensis, 17104, 17488.
  coerulescens, 17813.
  trigyna, 17814.
Pharbitis sp., 18748.
Phaseolus sp., 17287, 17317, 17318, 17324.
  angularis, 17315, 17316, 17319 to 17323, 17325, 17847, 17851, 18618.
  calcaratus, 17310 to 17314, 17850, 18444.
  max, 17305 to 17309, 18310.
  radiatus, 17096, 17134, 17283 to 17286, 17288 to 17304, 17326, 17512, 17696, 17722, 17848.
  vulgaris, 17858, 17859.
Phleum arenarium, 17815.
  asperum, 17816.
  boehmeri, 17817.
  intermedium, 17818.
  michelii, 17819, 18486.
  parnassicum, 17820.
  pratense, 16851, 16972, 17821, 18548.
  tenue, 17822.
Phoenix dactylifera, 17993, 18630, 18693 to 18698.
Physalis francheti, 17477.
Pinus sp., 17753, 17910.
  bungeana, 17911, 17912.
  edulis, 18499.
  gerardiana, 18404.
  insularis, 18665.
  koraiensis, 18914.
Piptatherum, virescens, 16803.
Pistache. See *Pistacia vera.*
Pistacia cabulica, 18635.
  chinensis, 17734, 17735, 18272, 18273, 18605.
  integerrima, 18637.
  vera, 17250, 17474, 18636, 18683.
Pisum sp., 18456.
  arvense, 16884, 17483, 17485 t 17487, 18396.
  elatius, 16883.
  jomardi, 17006.
  sativum, 16885, 18157, 18455.
Pittosporum tobira, 18564.
Plantago psyllium, 17007.
Plum (China), 17913, 17914, 18585, 18586.
Poa alpina, 18482.
  caespitosa, 17229.
  chaixii, 16806.
  compressa, 16973, 18419.
  fertilis, 16974, 17088.
  hybrida, 16805.
  memoralis, 16834, 17089.
    sempervirens, 17090.
  pratensis, 16835, 16936.
  sudetica, 16975.
  trivialis, 17091, 18327, 18663.
Pollinia fulva, 17046, 17230.
Pomelo (China), 18440.
  See also *Citrus decumana.*
Poppy. See *Papaver somniferum.*
Populus sp., 16915, 16925, 16926, 17174, 17175, 17742, 17743, 18269, 18274.
Potato, aquatic. See *Solanum commersoni.*
  (Bolivia), 18248 to 18255, 18786 to 18798.
  (Costa Rica), 18722 to 18725.
  See also *Solanum tuberosum.*
Poterium dodecandrum, 18480.
  officinale 18488.
Prickly pear. See *Opuntia* sp.; also *Nopalia* sp.
Prunus sp., 16918, 17732, 17733, 17913, 18585, 18586, 18587.
  armeniaca, 16917, 17152 to 17154, 17844, 17845, 18260, 18261, 18290, 18774 to 18782.
  avium, 18242.
  mahaleb, 18243.
Psidium guajava, 18769, 18770.
Psophocarpus tetragonolobus, 17717.
Pueraria thunbergiana, 18228.
Pumpkin, Turk's Crown, 18121.
  See also *Cucurbita pepo.*
Punica granatum, 18240.
Pyrus sp., 17176, 17177, 17727.
  communis, 17070.
  sinensis, 16911, 16916, 16924, 17178, 17723 to 17726.

Queensland nut. See *Macadamia ternifolia.*
Quercus sp., 17878.
  cuspidata, 17510.
  dentata, 17842, 17879, 18265.
  ilex, 16929.
  pubescens, 16930.

Radish (China), 17930 to 17937, 18437, 18449.
        See also *Raphanus sativus*.
Ragi. See *Eleusine coracana*.
Rambutan. See *Nephelium lappaceum*.
Raphanus sativus, 17930 to 17937, 18437, 18449.
Raphidophora merrillii, 18530.
Raspberry, red (Philippines), 16808.
Redtop. See *Agrostis alba*.
Rehmannia angulata, 17150.
Reseda sp., 18749.
Rhamnus sp., 17908, 17909, 18582.
Rice (Egypt), 18915 to 18921.
    Egyptian, 17144.
    (India), 16980 to 16984.
    (Japan), 17135 to 17137.
    (Persia), 18824 to 18826.
    Upland, 16807, 17914 to 17917, 18615, 18616.
        See also *Oryza sativa*.
Richardia aethiopica gigantea, 17443.
    africana nana compacta, 17441.
    albo maculata, 17445.
    aurata, 17447.
    childsiana, 17440.
    elliottiana, 17444.
    fragrans, 17439.
    hastata, 17446.
    praecox, 17442.
    rhemanni, 17448.
Ricinus communis, 17854, 18122, 18156, 18923.
Rosa sp., 17469, 17984.
    rugosa, 18576.
Rose (China), 17469, 17948.
Rubus sp., 16808, 17473, 17744.
Rush. See *Juncus* sp.

Saccharum ciliare, 17991.
    officinarum, 18322, 18323, 18409, 18410.
Sainfoin. See *Onobrychis onobrychis*.
Salix sp., 17179, 17737, 17738.
Sapindus utilis, 18436, 18476.
Sapium sebiferum, 18624.
Scorpiurus muricata, 16887.
    subvillosa, 16889, 17788.
    sulcata, 16886.
    vermiculata, 16888, 17789.
Sechium edule, 17133, 17282, 17511, 17996 to 17998, 18231.
Serradella. See *Ornithopus sativus*.
Sesamum indicum, 17919, 18607.
Sinapis alba, 18750.
Smilax sp., 18570.
Solanum commersoni, 17053, 17054, 17132.
    jamesii, 18342.
    melongena, 17062, 18543 to 18545.
    tuberosum, 18248 to 18255, 18722 to 18725, 18786 to 18798.
Sorghum, African, 17757.
        Sumac Cane, 18411.
    (African varieties), 16854 to 16861, 18160 to 18198.
    Amber, 17543, 17833, 17834, 18928, 18929, 18931.
    Austrian Sugar, 17560.
    (Bagdad), 17524.
    Black, 17561.
    Black-Hulled White Kafir, 17568, 17569, 17572, 18829.
    Black-Seeded, 17541, 17542, 18932.
    (China), 17920 to 17923, 18610 to 18614, 18625, 18626.
    Colman, 17556.
        Orange Cane, 17756.
    Collier, 17557, 17558.
    (Curacao), 18501 to 18504.
    Dadgi Jowar, 18935.
    Dari, 18388, 18389.
    Djougara balki, 18926.
    Djugara, 18936.
    Dshugara balcha, 18934.
    Durra, 17689.
    Dwarf Amber, 17544.
        milo, 17513, 18684, 18830.
    Early Amber Cane, 17695, 17702.
    Edra, 18933.
    Folger's Early, 17555.
    Gare, 18939.
    Giant milo, 17691.
    Guinea corn, 18633.
    (India), 17535 to 17537, 18326.
        (Grown from Indian sorghums), 17573 to 17687.
    Jerusalem corn, 18343.
    Kaulien, 18518.
    Orange, 17547 to 17552.
    (Persia), 18309.
    Planter's Friend, 17538, 17539, 18927, 18930.
    Red, 18938.
        Kafir, 17566, 17567, 18344.
    Russian sugar, 17559.
    Sapling, 17688.
    Shallu, 17690.
    Simmon's Cane, 17490.
    Sourless, 17984.
    S. saccharatum, 17540,
    Sumac, 17554.
        Cane, 18203.
    Texas Gooseneck, 17553.
    Undendibule, 17545, 17546.
    White, 18937.
        Hulled White Kafir, 17571.
        milo, 17570.
        of Rey Barelly, 18940.
    Yellow milo, 17562 to 17565, 18345.
        See also *Andropogon sorghum*.
Soy bean, black, 17251 to 17255, 18227, 18460.
    brown, 17256 to 17259.
    (China) 17852, 17857, 17861, 17862, 18258, 18259,
    green, 17260, 17261, 18459.

Soy bean, greenish yellow, 17262 to17267.
Hollybrook Early, 17520.
(Siberia), 18227.
yellow, 17268 to 17280.
See also *Glycine hispida.*
"Spanish thyme" (Bahamas), 18735.
Spartium scoparium, 17008.
"Spinach" (Bahamas), 18740.
Spinacia oleracea, 17924.
Spiraea sp., 18283, 18291.
Spodiopogon cotulifer, 18379.
Sporobolus lindleyi, 17048.
Squash. See *Cucurbita maxima.*
Sterculia foetida, 17139.
Stipa elegantissima, 17049.
tenacissima, 16976.
tuckeri, 17050.
Streptosolen amabilis magnifica, 17438.
Sulla. See *Hedysarum coronarium.*
Sweet potato (Baluchistan), 18402.
(Jamaica), 18297, 18298.
See also *Ipomoea batatas.*
Syncarpia laurifolia, 16867, 18688.
Syntherisma sanguinalis, 16901.

Tallow tree. See *Sapium sebiferum.*
Tamarindus indica, 18738.
Tamarix sp., 18268.
Taro. See *Colocasia* spp.
Teff. See *Eragrostis abyssinica.*
Teosinte. See *Euchlaena mexicana.*
Thuja orientalis, 17926.
Timothy. See *Phleum pratense.*
Tobacco (China), 17927, 17928.
(Italy), 17465.
See also *Nicotiana tabacum.*
"Tree pea," 18427.
Trifolium sp., 18461.
alpinum, 18498.
caespitosum, 18497.
hybridum, 18547.
incarnatum, 16977 to 16979, 17841, 17999, 18420.
medium, 18421.
pratense, 17508, 17840, 18001 to 18118, 18394, 18412, 18510, 18511, 18546, 18551 to 18556, 18913.
repens, 18692.
Trigonella corniculata, 18151.
foenum-graecum, 18506.
Trisetum pratense, 16950.
Triticum dicoccum, 17098.
durum, 17097, 17471.
turgidum, 17830.
vulgare, 17825, 17947, 17994, 18457.
Tuna. See *Opuntia* sp.
Typhonium trilobatum, 18763.

Udo. See *Aralia cordata.*
Ulex europaeus, 17092.
Ulmus sp., 16909.

Vanilla sp., 18733.
Vetch, bitter. See *Lathyrus sativus.*
kidney. See *Anthyllis vulneraria.*
Vetch, milk. See *Astragalus.*
See also *Vicia* spp.
Viburnum odoratissimum, 18583.
Vicia sp., 16928, 18456.
agrigentina, 17009.
ambigua, 17010.
americana, 16811.
amoena lanata, 18380.
atropurpurea, 18132.
biennis, 17011.
calcarata, 17012, 18141, 18803.
cassubica, 17013.
cordata, 17014, 18804.
cornigera, 17015, 18805.
cuspidata, 17016, 18806.
disperma, 17017, 18807.
faba, 17164, 17853, 17860, 18137, 18142, 18143, 18241, 18340, 18434.
ferruginea, 17018, 18808.
fulgens, 18202.
gerardi, 17019, 18809.
glabrescens, 17496.
globosa, 17020, 18810.
grandiflora, 17021, 17790, 18811.
hybrida, 17022, 18812.
lutea, 17023, 18136.
macrocarpa, 17024, 18813.
michauxii, 18814.
monanthos, 18139, 18140.
multiflora, 17025.
narbonnensis, 18815.
nissoliana, 18131.
onobrychioides, 17026, 18816.
orobus, 17791.
pannonica, 17027, 18135, 18817.
peregrina, 17028, 18818.
picta, 17029, 18819.
pseudo-cracca, 17030, 18820.
sativa, 18338, 18674.
macrocarpa, 18138.
obovata, 18134.
spuria, 17032, 18821.
striata, 17033, 18822.
sylvatica, 17031, 17792.
tricolor, 17034. 18823.
unijuga, 18381.
varia, 18133.
villosa, 18422, 18700.
glabrescens, 18159.
Vigna unguiculata, 16812, 17327 to 17437, 17492, 17493, 17519, 17693, 17697, 17849, 17855, 17856, 18472, 18473, 18519 to 18522, 18617.
Vitex sp., 17941.
Vitis sp., 16927, 17157 to 17161, 17467. 17468, 17755, 18602.
munsoniana, 17964.
vinifera, 17155, 17156, 17718, 17719, 18392, 18407.
Voandzeia subterranea, 16942, 17058.

Walnut (China), 17745 to 17747, 17929, 17943 to 17946, 18256, 18257, 18263, 18603, 18604.
See also *Juglans* spp.
Wampee. See *Peltandra sagittifolia*

Watermelon (Persia), 18308.
  See also *Citrullus vulgaris*.
Wheat. See *Triticum* spp.
Wistaria chinensis, 17949.

Xanthoceras sorbifolia, 18264.
Xanthosoma sp., 16810, 16946 to 16948, 17149, 17453 to 17463, 17986, 18204 to 18224, 18319, 18634.
  robustum, 18762.
  sagittifolium, 17703.
  violaceum, 18385, 18761.
Xanthoxylum sp., 17181, 17951.
  bungei, 17952.

Yam. See *Dioscorea* spp.

Yang taw. See *Actinidia chinensis*.
Yautia (Ceylon), 17453 to 17461.
  (Kamerun), 16946 to 16948.
  Linares, 17149.
  "Oto," 16810.
  (Philippines), 18319.
  (Porto Rico), 18204 to 18224.
  White Tanier, 17987.
  Yellow Tanier, 17986.
    See also *Xanthosoma* spp.

Zea mays, 17516 to 17518, 17523, 17692, 17880, 17881, 18200, 18201, 18302, 18426, 18531 to 18534, 18679, 18680, 18742 to 18745.
Zizyphus sativa, 17752, 17892, 18565.

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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 107.

B. T. GALLOWAY, *Chief of Bureau.*

AMERICAN ROOT DRUGS.

BY

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Assistant, Drug-Plant Investigations.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., April 16, 1907.

Sir: I have the honor to transmit herewith and to recommend for publication as Bulletin No. 107 of the series of this Bureau the accompanying manuscript, entitled "American Root Drugs." This paper was prepared by Miss Alice Henkel, Assistant in Drug-Plant Investigations, and has been submitted by the Physiologist in charge with a view to its publication.

The fifty drugs described include all the "official" roots found in this country, besides such "nonofficial" drugs as are most frequently quoted in drug catalogues.

There is a steady demand for information concerning the medicinal plants of this country, and this bulletin on American root drugs has been prepared as a first installment on the subject. It is intended as a guide and reference book for farmers, drug collectors, druggists, students, and others who may be interested in one way or another in the collection or study of our medicinal flora.

Respectfully,
B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

CONTENTS.

Page.
Introduction 9
The collection of root drugs 10
Plants furnishing root drugs 11
- Male-fern (*Dryopteris filix-mas* and *D. marginalis*) 11
- Couch-grass (*Agropyron repens*) 12
- Wild turnip (*Arisaema triphyllum*) 13
- Skunk-cabbage (*Spathyema foetida*) 15
- Sweet-flag (*Acorus calamus*) 16
- Chamaelirium, or Helonias (*Chamaelirium luteum*) 17
- American hellebore (*Veratrum viride*) 18
- Aletris (*Aletris farinosa*) 19
- Bethroot (*Trillium erectum*) 20
- Wild yam (*Dioscorea villosa*) 21
- Blue flag (*Iris versicolor*) 22
- Lady's-slipper (*Cypripedium hirsutum* and *C. parviflorum*) 23
- Crawley-root (*Corallorhiza odontorhiza*) 24
- Canada snakeroot (*Asarum canadense*) 25
- Serpentaria (*Aristolochia serpentaria* and *A. reticulata*) 26
- Yellow dock (*Rumex crispus*) 27
- Pokeweed (*Phytolacca decandra*) 29
- Soapwort (*Saponaria officinalis*) 31
- Goldenseal (*Hydrastis canadensis*) 31
- Goldthread (*Coptis trifolia*) 34
- Black cohosh (*Cimicifuga racemosa*) 35
- Oregon grape (*Berberis aquifolium*) 36
- Blue cohosh (*Caulophyllum thalictroides*) 37
- Twinleaf (*Jeffersonia diphylla*) 38
- May-apple (*Podophyllum peltatum*) 39
- Canada moonseed (*Menispermum canadense*) 40
- Bloodroot (*Sanguinaria canadensis*) 40
- Hydrangea (*Hydrangea arborescens*) 41
- Indian-physic (*Porteranthus trifoliatus*) 42
- Wild indigo (*Baptisia tinctoria*) 43
- Crane's-bill (*Geranium maculatum*) 44
- Seneca snakeroot (*Polygala senega*) 45
- Stillingia (*Stillingia sylvatica*) 47
- Wild sarsaparilla (*Aralia nudicaulis*) 48
- Ginseng (*Panax quinquefolium*) 49
- Water-eryngo (*Eryngium yuccifolium*) 50
- American angelica (*Angelica atropurpurea*) 51
- Yellow jasmine or jessamine (*Gelsemium sempervirens*) 51

Plants furnishing root drugs—Continued. Page.

Pinkroot (*Spigelia marilandica*) 52
American colombo (*Frasera carolinensis*) 53
Black Indian hemp (*Apocynum cannabinum*) 55
Pleurisy-root (*Asclepias tuberosa*) 56
Comfrey (*Symphytum officinale*) 57
Stoneroot (*Collinsonia canadensis*) 58
Culver's-root (*Veronica virginica*) 59
Dandelion (*Taraxacum officinale*) 60
Queen-of-the-meadow (*Eupatorium purpureum*) 61
Elecampane (*Inula helenium*) 62
Echinacea (*Brauneria angustifolia*) 63
Burdock (*Arctium lappa*) 64
Explanation of plates 68
Index 69

ILLUSTRATIONS.

PLATES.

Page.

PLATE I. Fig. 1.—Marginal-fruited shield-fern (*Dryopteris marginalis*). Fig. 2.—Skunk-cabbage (*Spathyema foetida*). Fig. 3.—Sweet-flag (*Acorus calamus*). Fig. 4.—Bethroot (*Trillium erectum*) 68
II. Fig. 1.—Chamaelirium (*Chamaelirium luteum*). Fig. 2.—Aletris (*Aletris farinosa*). Fig. 3.—Wild yam (*Dioscorea villosa*). Fig. 4.—Blue flag (*Iris versicolor*) 68
III. Fig. 1.—Large yellow lady's-slipper (*Cypripedium hirsutum*). Fig. 2.—Canada snakeroot (*Asarum canadense*). Fig. 3.—Virginia serpentaria (*Aristolochia serpentaria*). Fig. 4.—Soapwort (*Saponaria officinalis*) 68
IV. Fig. 1.—Oregon grape (*Berberis aquifolium*). Fig. 2.—Blue cohosh (*Caulophyllum thalictroides*). Fig. 3.—Canada moonseed (*Menispermum canadense*). Fig. 4.—Hydrangea (*Hydrangea arborescens*). 68
V. Fig. 1.—Indian-physic (*Porteranthus trifoliatus*). Fig. 2.—Wild sarsaparilla (*Aralia nudicaulis*). Fig. 3.—Ginseng (*Panax quinquefolium*). Fig. 4.—Water-eryngo (*Eryngium yuccifolium*) 68
VI. Fig. 1.—American angelica (*Angelica atropurpurea*). Fig. 2.—Pinkroot (*Spigelia marilandica*). Fig. 3.—Pleurisy-root (*Asclepias tuberosa*). Fig. 4.—Comfrey (*Symphytum officinale*) 68
VII. Fig. 1.—Stoneroot (*Collinsonia canadensis*). Fig. 2.—Queen-of-the-meadow (*Eupatorium purpureum*). Fig. 3.—Elecampane (*Inula helenium*). Fig. 4.—Echinacea (*Brauneria angustifolia*) 68

TEXT FIGURES.

FIG. 1. Couch-grass (*Agropyron repens*) 13
2. Wild turnip (*Arisaema triphyllum*) 14
3. American hellebore (*Veratrum viride*) 19
4. Crawley-root (*Corallorhiza odontorhiza*) 25
5. Yellow dock (*Rumex crispus*), first year's growth 27
6. Broad-leaved dock (*Rumex obtusifolius*), leaf, fruiting spike, and root. 28
7. Pokeweed (*Phytolacca decandra*), flowering and fruiting branch...... 30
8. Pokeweed root 30
9. Goldenseal (*Hydrastis canadensis*), flowering plant and fruit......... 32
10. Goldenseal rootstock 33
11. Goldthread (*Coptis trifolia*) 34
12. Black cohosh (*Cimicifuga racemosa*), leaves, flowering spikes, and rootstock 35
13. Twinleaf (*Jeffersonia diphylla*), plant and seed capsule................ 38

Page.
FIG. 14. May-apple (*Podophyllum peltatum*), upper portion of plant with flower, and rootstock 39
15. Bloodroot (*Sanguinaria canadensis*), flowering plant with rootstock 41
16. Wild indigo (*Baptisia tinctoria*), branch showing flowers and seed pods 43
17. Crane's-bill (*Geranium maculatum*), flowering plant, showing also seed pods and rootstock 45
18. Seneca snakeroot (*Polygala senega*), flowering plant with root 46
19. Stillingia (*Stillingia sylvatica*), upper portion of plant and part of spike showing male flowers 47
20. Yellow jasmine (*Gelsemium sempervirens*) 52
21. American colombo (*Frasera carolinensis*), leaves, flowers, and seed pods 54
22. Black Indian hemp (*Apocynum cannabinum*), flowering portion, pods, and rootstock 55
23. Culver's-root (*Veronica virginica*), flowering top and rootstock 59
24. Dandelion (*Taraxacum officinale*) 61
25. Burdock (*Arctium lappa*), flowering branch and root 64

DEC 30 1907

B. P. I.—283.

AMERICAN ROOT DRUGS.

INTRODUCTION.

More than half of the root drugs recognized in the Eighth Decennial Revision of the United States Pharmacopœia occur in this country, some native and not growing elsewhere and others introduced. All of the official root drugs found in the United States have been included in this bulletin, as well as such native and introduced "nonofficial" roots (those not at present recognized in the United States Pharmacopœia) as seemed to be most generally quoted in the trade lists of the country, the total number of root drugs described being 50. While the most important root drugs thus given are limited to 50, there are included under each of these, wherever required, brief descriptions of related species. It would be impossible to include within the limits of this paper all of the root drugs that are used in this country, but the aim has been to give information concerning those which seem to be the most important commercially, according to the numerous drug lists that have been consulted.

All of the root drugs herein mentioned occur in quantities sufficient for commercial purposes, but the roots of many of the species that also occur in other countries are nevertheless largely imported.

In speaking of "root drugs" in this paper only those are included of which the underground portion is found in commerce, whether in the form of root, rootstock, bulb, or corm, excluding the roots that are used solely for their bark or for their gums or resins.

Except in the botanical descriptions, the term "roots" is generally used, regardless of the fact that the part under consideration may be a rootstock, root, or bulb. In this the commercial practice is followed, which makes no distinction as to the form of the underground portion as classified by botanists, but catalogues them all under the general term "roots."

The medicinal uses are referred to in only the briefest and most general manner, for it is clearly not within the province of a publication of this character to go into details regarding these matters. The statements made are based on the information contained in various dispensatories and other works relating to materia medica.

The illustrations are for the most part made from a collection of photographs taken from nature by C. L. Lochman. A few have been taken from various publications, mention of which is made under the illustrations in question.

THE COLLECTION OF ROOT DRUGS.

Generally speaking, the roots of annual plants should be dug just before flowering, and those of biennial or perennial plants late in autumn or early in spring, the object being to collect them at a period when there is a cessation of growth; for besides shrinking more and weighing less if collected during the growing season, they are also deficient in medicinal properties. Very frequently a drug is of inferior quality simply because the collector has neglected to gather it in the proper season.

It is unfortunate that so much confusion exists with regard to the common names of American plants. The common name of a plant in one locality may be the same as that of an entirely different plant in another locality, and on account of this confusion the collector is not always sure of the identity of the plant he is collecting, nor the drug dealer as to what he will receive, unless a sample is submitted to him. If more care were exercised in this respect it would mean a saving of time and money to both collector and dealer.

Another important matter that the collector sometimes overlooks is the proper cleaning and drying of the roots. To insure a good market for his crude drugs the collector should be certain not only that he has the right plant, but that it is collected at the proper season of the year, and that he has a clean and thoroughly dried article.

After the roots have been dug they should be freed from dirt and all foreign particles, such as stones and bits of other plants. If the adherent soil can not be removed by shaking the roots, they may, in most instances, be washed in clean water, after which they should be carefully dried. In some cases the roots are sliced or split when green in order to facilitate drying, and wherever this is necessary it will be indicated under the descriptions of the different plants.

For the purpose of drying, the roots should be spread out in thin layers on racks or shelves, or on clean, well-ventilated barn floors or lofts, exposed to light and air but not direct sunlight, and turned occasionally each day until thoroughly dry. If the roots are dried out of doors, they should be placed under shelter at night or upon the approach of damp or rainy weather. Thoroughly dried roots snap readily when bent, and it requires from three to six weeks to cure roots, depending upon the weather conditions and the character of the roots.

Burlap or gunny sacks, or dry, clean barrels may be used for packing the roots for shipment.

The collector should always communicate with the dealers concerning the drugs to be disposed of, sending them a representative sample, plainly marked as to contents, with the name and address of the sender, and stating how large a quantity can be furnished.

The prices per pound mentioned in this bulletin will serve to give the collector an idea as to what he may expect to receive from dealers, but, as with other commodities, depending for their prices upon supply and demand, fluctuations are likely to occur from year to year. An increased demand or a shortage will send prices upward and stimulate collection, which in turn may result in glutting the market, and a decline in prices naturally follows. It is possible, therefore, to give only an approximate range of prices.

PLANTS FURNISHING ROOT DRUGS.

Under each plant will be found synonyms and pharmacopœial name, if any, the common names, habitat, range, descriptions of the plant and root, and information concerning collection, prices, and uses, while in the case of goldenseal and ginseng the methods of culture are included.

MALE-FERN.

(1) *Dryopteris filix-mas* (L.) Schott and (2) *Dryopteris marginalis* (L.) A. Gray.

Synonyms.—(1) *Aspidium filix-mas* Sw. (2) *Aspidium marginale* Sw.

Pharmacopœial name.—Aspidium.

Other common names.—(1) Male shield-fern, sweet brake, knotty brake, basket-fern, bear's-paw root; (2) marginal-fruited shield-fern, evergreen wood-fern.

Habitat and range.—These ferns are found in rocky woods, the male shield-fern inhabiting the region from Canada westward to the Rocky Mountains and Arizona. It is widely distributed also through Europe, northern Asia, northern Africa, and South America. The marginal-fruited shield-fern (Pl. I, fig. 1), one of our most common ferns, occurs from Canada southward to Alabama and Arkansas.

Description of plants.—Both of these species are tall, handsome ferns, the long, erect fronds, or leaves, arising from a chaffy, scaly base, and consisting of numerous crowded stemless leaflets, which are variously divided and notched. There is but little difference between these two species. The male shield-fern is perhaps a trifle stouter, the leaves growing about 3 feet in length and having a bright-green color, whereas the marginal-fruited shield-fern has lighter green leaves, about 2½ feet in length, and is of more slender appearance. The principal difference, however, is found in the arrangement of the "sori," or "fruit dots." These are the very small, round, tawny dots that are found on the backs of fern leaves, and in the male shield-fern these will be found arranged in short rows near the midrib, while in the marginal-fruited shield-fern, as this name indicates, the fruit dots are placed on the margins of the fronds. Both plants are perennials and members of the fern family (Polypodiaceæ).

Description of the rootstock.—These ferns have stout ascending or erect chaffy rootstalks, or rhizomes (Pl. I, fig. 1) as they are technically known. As taken from the ground the rootstock is from 6 to 12 inches in length and 1 to 2 inches thick, covered with closely overlapping, brown, slightly curved stipe bases or leaf bases and soft, brown, chaffy scales. The inside of the rootstock is pale green. As found in the stores, however, male-fern with the stipe bases and roots removed measures about 3 to 6 inches in length and about one-half to 1 inch in thickness, rough where the stipe bases have been removed, brown outside, pale green and rather spongy inside.

The stipe bases remain green for a very long period, and these small, claw-shaped, furrowed portions, or "fingers" as they are called, form a large proportion of the drug found on the American market and, in fact, are said to have largely superseded the rootstock. Male-fern has a disagreeable odor, and the taste is described as bitter-sweet, astringent, acrid, and nauseous.

Collection, prices, and uses.—The best time for collecting male-fern root is from July to September. The root should be carefully cleaned, but not washed, dried out of doors in the shade as quickly as possible, and shipped to druggists at once. The United States Pharmacopœia directs that "the chaff, together with the dead portions of the rhizome and stipes, should be removed, and only such portions used as have retained their internal green color."

Great care is necessary in the preservation of this drug in order to prevent it from deteriorating. If kept too long, its activity will be impaired, and it is said that it will retain its qualities much longer if it is not peeled until required for use. The unreliability sometimes attributed to this drug can in most instances be traced to the presence of the rootstocks of other ferns with which it is often adulterated, or it will be found to be due to improper storing or to the length of time that it has been kept.

The prices paid for male-fern root range from 5 to 10 cents a pound.

Male-fern, official in the United States Pharmacopœia, has been used since the remotest times as a remedy for worms. Grave results are sometimes caused by overdoses.

COUCH-GRASS.

Agropyron repens (L.) Beauv.

Synonym.—*Triticum repens* L.

Pharmacopœial name.—Triticum.

Other common names.—Dog-grass, quick-grass, quack-grass, quitch-grass, quake-grass, scutch-grass, twitch-grass, witch-grass, wheat-grass, creeping wheat-grass, devil's-grass, durfa-grass, Durfee-grass, Dutch-grass, Fin's-grass, Chandler's-grass.

Habitat and range.—Like many of our weeds, couch-grass was introduced from Europe, and is now one of the worst pests the farmer has to contend with, taking possession of cultivated ground and crowding out valuable crops. It occurs most abundantly from Maine to Maryland, westward to Minnesota and Missouri, and is spreading on farms on the Pacific slope, but is rather sparingly distributed in the South.

Description of plant.—Couch-grass is rather coarse, 1 to 3 feet high, and when in flower very much resembles rye or beardless wheat (fig. 1). Several round, smooth, hollow stems, thickened at the joints, are produced from the long, creeping, jointed rootstock. The stems bear 5 to 7 leaves from 3 to 12 inches long, rough on the upper surface and smooth beneath, while the long, cleft leaf sheaths are smooth. The solitary terminal flowering heads or spikes are compressed, and consist of two rows of spikelets on a wavy and flattened axis. These heads are produced from July to September. Couch-grass belongs to the grass family (Poaceæ).

Description of rootstock.—The pale-yellow, smooth rootstock is long, tough, and jointed, creeping along underneath the ground and pushing in every direction. As found in the stores, it consists of short, angular pieces, from one-eighth to one-fourth of an inch long, of a shining straw color, and hollow. These pieces are odorless, but have a somewhat sweetish taste.

Collection, prices, and uses.—Couch-grass, which is official in the United States Pharmacopœia, should be collected in spring, carefully cleaned, and the rootlets removed. The rootstock (not the rootlets) is then cut into short pieces, about two-fifths of an inch in length, for which purpose an ordinary feed-cutting machine may be used, and thoroughly dried.

Couch-grass is usually destroyed by plowing up and burning, for if any of the joints are permitted to remain in the soil new plants will be produced. But, instead of burning, the rootstocks may be saved and prepared for the drug market in the manner above stated. The prices range from 3 to 5 cents a pound. At present couch-grass is collected chiefly in Europe.

A fluid extract is prepared from couch-grass, which is used in affections of the kidney and bladder.

WILD TURNIP.

Arisaema triphyllum (L.) Torr.

Synonym.—*Arum triphyllum* L.

Other common names.—Arum, three-leaved arum, Indian turnip, jack-in-the-pulpit, wake-robin, wild pepper, dragon-turnip, brown dragon, devil's-ear, marsh-turnip, swamp-turnip, meadow-turnip, pepper-turnip, starchwort, bog-onion, priest's-pintle, lords-and-ladies.

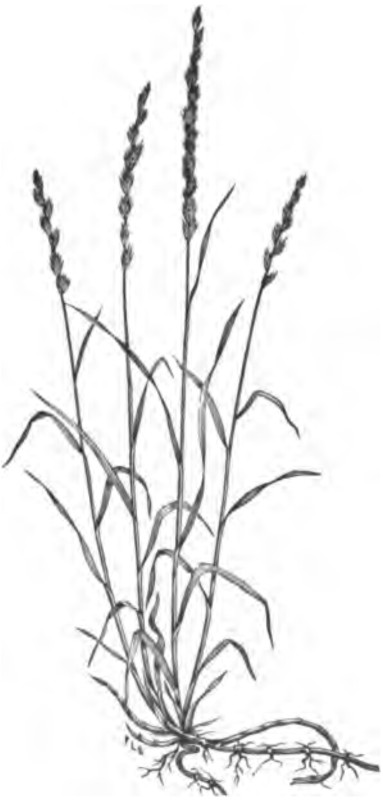

FIG. 1.—Couch-grass (*Agropyron repens*).

Habitat and range.—Wild turnip inhabits moist woods from Canada to Florida and westward to Kansas and Minnesota.

Description of plant.—Early in April the quaint green and brownish purple hooded flowers of the wild turnip may be seen in the shady depths of the woods.

It is a perennial plant belonging to the arum family (Araceæ), and reaches a height of from 10 inches to 3 feet. The leaves, of which there are only one or two, unfold with the flowers; they are borne on long, erect, sheathing stalks, and consist of three smooth, oval leaflets; the latter are 3 to 6 inches long, and from 1½ to 3½ inches wide, net veined, and with one vein running parallel with the margins. The "flower" is curiously formed, somewhat like the calla lily, consisting of what is known botanically as a spathe, within which is inclosed the spadix. The spathe is an oval, leaflike part, the lower portion of which, in the flower under consideration, is rolled together so as to form a tube, while the upper, pointed part is usually bent forward, thus forming a flap or hood over the tube-shaped part which contains the spadix. (Fig. 2.) In fact it is very similar to the familiar flower of the calla lily of the gardens, except that, instead of being white, the wild turnip is either all green or striped with very dark purple, sometimes seeming almost black, and in the calla lily the "flap" is turned back, whereas in the wild turnip it is bent forward over the tube. Inside of the spathe is the spadix, also green or purple, which is club shaped, rounded at the summit, and narrowly contracted at the base, where it is surrounded by either the male or female flowers or both, in the latter case (the most infrequent) the male flowers being placed below the female flowers. In autumn the fruit ripens in the form of a bunch of bright scarlet, shining berries. The entire plant is acrid, but the root more especially so.

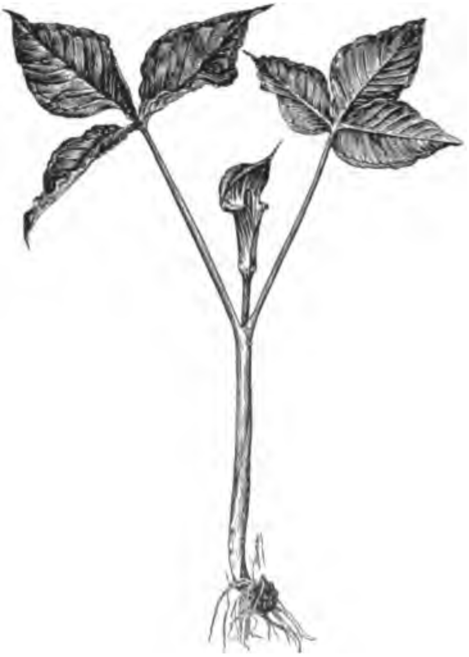

FIG. 2.—Wild turnip (*Arisæma triphyllum*).

Description of "root."—The underground portion of this plant is known botanically as a "corm," and is somewhat globular and shaped like a turnip. The lower part of the corm is flat and wrinkled, while the upper part is surrounded by coarse, wavy rootlets. The outside is brownish gray and the inside white and mealy. It has no odor, but an intensely acrid, burning taste, and to those who may have been induced in their school days to taste of this root wild turnip will be familiar chiefly on account of its never-to-be-forgotten acrid, indeed caustic, properties. The dried article of commerce consists of round, white slices, with brown edges, only slightly shrunken, and breaking with a starchy fracture.

Collection, prices, and uses.—The partially dried corm is used in medicine. It is dug in summer, transversely sliced, and dried. When first dug it is intensely acrid, but drying and heat diminish the acridity. It loses its acridity rapidly with age. Wild turnip brings from 7 to 10 cents a pound.

The corm of wild turnip, which was official in the United States Pharmacopœia from 1820 to 1870, is used as a stimulant, diaphoretic, expectorant, and irritant.

SKUNK-CABBAGE.

Spathyema foetida (L.) Raf.

Synonyms.—*Dracontium foetidum* L.; *Symplocarpus foetidus* Nutt.

Other common names.—Dracontium, skunkweed, polecat-weed, swamp-cabbage, meadow-cabbage, collard, fetid hellebore, stinking poke, pockweed.

Habitat and range.—Swamps and other wet places from Canada to Florida, Iowa, and Minnesota abound with this ill-smelling herb.

Description of plant.—Most of the common names applied to this plant, as well as the scientific names, are indicative of the most striking characteristic of this early spring visitor, namely, the rank, offensive, carrion odor that emanates from it. Skunk-cabbage is one of the very earliest of our spring flowers, appearing in February or March, but it is safe to say that it is not likely to suffer extermination at the hands of the enthusiastic gatherer of spring flowers. In the latitude of Washington skunk-cabbage has been known to be in flower in December.

It is a curious plant, with its hood-shaped, purplish striped flowers appearing before the leaves. It belongs to the arum family (Araceæ) and is a perennial. The "flower" is in the form of a thick, ovate, swollen spathe, about 3 to 6 inches in height, the top pointed and curved inward, spotted and striped with purple and yellowish green. The spathe is not open like that of the wild turnip or calla lily, to which family this plant also belongs, but the edges are rolled inward, completely hiding the spadix. In this plant the spadix is not spike-like, as in the wild turnip, but is generally somewhat globular, entirely covered with the numerous, dull-purple flowers. (Pl. I, fig. 2.) After the fruit has ripened the spadix will be found to have grown considerably, the spathe meantime having decayed.

The leaves, which appear after the flower, are numerous and very large, about 1 to 3 feet in length and about 1 foot in width; they are thin in texture, but prominently nerved with fleshy nerves, and are borne on deeply channeled stems.

Description of rootstock.—Skunk-cabbage has a thick, straight, reddish brown rootstock, from 3 to 5 inches long, and about 2 inches in diameter, and having a whorl of crowded fleshy roots (Pl. I, fig. 2) which penetrate the soil to considerable depth. The dried article of commerce consists of either the entire rootstock and roots, which are dark brown and wrinkled on the outside, whitish and starchy within, or of very much compressed, wrinkled, transverse slices. When bruised, the root has the characteristic fetid odor of the plant and possesses a sharp acrid taste, both of which become less the longer the root is kept.

Collection, prices, and uses.—The rootstock of skunk-cabbage should be collected early in spring, soon after the appearance of the flower, or after the seeds have ripened, in August or September. It should be carefully dried, either in its entire state or deprived of the roots and cut into transverse slices. Skunk-cabbage loses its odor and acridity with age, and should therefore not be kept longer than one season. The range of prices is from 4 to 7 cents a pound.

Skunk-cabbage, official from 1820 to 1880, is used in affections of the respiratory organs, in nervous disorders, rheumatism, and dropsical complaints.

SWEET-FLAG.

Acorus calamus L.

Pharmacopœial name.—Calamus.

Other common names.—Sweet cane, sweet grass, sweet myrtle, sweet rush, sweet sedge, sweet segg, sweetroot, cinnamon-sedge, myrtle-flag, myrtle-grass, myrtle-sedge, beewort.

Habitat and range.—This plant frequents wet and muddy places and borders of streams from Nova Scotia to Minnesota, southward to Florida and Texas, also occurring in Europe and Asia. It is usually partly immersed in water, and is generally found in company with the cat-tail and other water-loving species of flag.

Description of plant.—The swordlike leaves of the sweet-flag resemble those of other flags so much that before the plant is in flower it is difficult to recognize simply by the appearance of its leaves. The leaves of the blue flag or "poison-flag," as it has been called, are very similar to those of the sweet-flag, and this resemblance often leads to cases of poisoning among children who thus mistake one for the other. However, as the leaves of the sweet-flag are fragrant, the odor will be a means of recognizing it. Of course when the sweet-flag is in flower the identification of the plant is easy.

The sheathing leaves of this native perennial, which belongs to the arum family (Araceæ), are from 2 to 6 feet in height and about 1 inch in width; they are sharp pointed and have a ridged midrib running their entire length. The flowering head, produced from the side of the stalk, consists of a fleshy spike sometimes 3½ inches long and about one-half inch in thickness, closely covered with very small greenish yellow flowers, which appear from May to July. (Pl. I, fig. 3.)

Description of rootstock.—The long, creeping rootstock of the sweet-flag is thick and fleshy, somewhat spongy, and producing numerous rootlets. (Pl. I, fig. 3.) The odor is very aromatic and agreeable, and the taste pungent and bitter. The dried article, as found in the stores, consists of entire or split pieces of various lengths, from 3 to 6 inches, light brown on the outside with blackish spots, sharply wrinkled lengthwise, the upper surface marked obliquely with dark leaf scars, and the lower surface showing many small circular scars, which, at first glance, give one the impression that the root is worm-eaten, but which are the remains of rootlets that have been removed from the rootstock. Internally the rootstock is whitish and of a spongy texture. The aromatic odor and pungent, bitter taste are retained in the dried article.

Collection, prices, and uses.—The United States Pharmacopœia directs that the unpeeled rhizome, or rootstock, be used. It is collected either in early spring or late in autumn. It is pulled or grubbed from the soft earth, freed from adhering dirt, and the rootlets removed, as these are not so aromatic and more bitter. The rootstock is then carefully dried, sometimes by means of moderate heat. Sweet-flag deteriorates with age and is subject to the attacks of worms. It loses about three-fourths of its weight in drying.

Some of the sweet-flag root found in commerce consists of handsome white pieces. These usually come from Germany, and have been peeled before drying, but they are not so strong and aromatic as the unpeeled roots. Unpeeled sweet-flag root brings from 3 to 6 cents a pound.

Sweet-flag is employed as an aromatic stimulant and tonic in feeble digestion. The dried root is frequently chewed for the relief of dyspepsia.

CHAMAELIRIUM, OR HELONIAS.

Chamaelirium luteum (L.) A. Gray.

Synonym.—*Helonias dioica* Pursh.

Other common names.—Unicorn-root, false unicorn-root, blazingstar, drooping starwort, starwort, devil's-bit, unicorn's-horn.

In order to avoid the existing confusion of common names of this plant, it is most desirable to use the scientific names Chamaelirium or Helonias exclusively. Chamaelirium is the most recent botanical designation and will be used throughout this article, but the synonym Helonias is a name very frequently employed by the drug trade. The plant with which it is so much confused, *Aletris farinosa*, will also be designated throughout by its generic name, Aletris.

Habitat and range.—This native plant is found in open woods from Massachusetts to Michigan, south to Florida and Arkansas.

Description of plant.—Chamaelirium and Aletris (*Aletris farinosa*) have long been confused by drug collectors and others, owing undoubtedly to the transposition of some of their similar common names, such as "starwort" and "stargrass." The plants can scarcely be said to resemble each other, however, except perhaps in their general habit of growth. (See Pl. II, figs. 1 and 2.)

The male and female flowers of Chamaelirium are borne on separate plants, and in this respect are entirely different from Aletris; neither do the flowers resemble those of Aletris.

Chamaelirium is an erect, somewhat fleshy herb, perennial, and belongs to the bunchflower family (Melanthiaceæ). The male plant grows to a height of from 1½ to 2½ feet, and the female plant is sometimes 4 feet tall and is also more leafy.

The plants have both basal and stem leaves, whereas Aletris has only the basal leaves. The basal leaves of Chamaelirium are broad and blunt at the top, narrowing toward the base into a long stem; they are sometimes so much broadened at the top that they may be characterized as spoon shaped, and are from 2 to 8 inches long and from one-half to 1½ inches wide. The stem leaves are lance shaped and sharp pointed, on short stems or stemless. (Pl. II, fig. 1.)

The white starry flowers of Chamaelirium are produced from June to July, those of the male plant being borne in nodding, graceful, plumelike spikes 3 to 9 inches long (Pl. II, fig. 1) and those of the female plant in erect spikes. The many-seeded capsule is oblong, opening by three valves at the apex.

Another species is now recognized, *Chamaelirium obovale* Small, which seems to differ chiefly in having larger flowers and obovoid capsules.

Description of rootstock.—The rootstock of Chamaelirium does not in the least resemble that of Aletris, with which it is so generally confused. It is from one-half to 2 inches in length, generally curved upward at one end in the form of a horn (whence the common name, "unicorn") and having the appearance of having been bitten off. (Pl. II, fig. 1.) It is of a dark-brown color, with fine transverse wrinkles, rough, on the upper surface showing a few stem scars, and giving off from all sides numerous brown fibrous rootlets. The more recent rootlets have a soft outer covering, which in the older rootlets has worn away, leaving the fine but tough and woody whitish center. The rootlets penetrate to the central part of the rootstock, and this serves as a distinguishing character from Aletris, as a transverse section of Chamaelirium very plainly shows these fibers extending some distance within the rootstock. Furthermore, the rootstock of Chamaelirium exhibits a number of small holes wherever these rootlets have broken off, giving it the appearance of having become "wormy." It is hard and horny within and has a peculiar odor and a very bitter, disagreeable taste, whereas Aletris is not at all bitter.

Collection, prices, and uses.—Chamaelirium should be collected in autumn. The prices paid to collectors may be said to range from about 30 to 45 cents a pound. In the fall of 1906 a scarcity of this root was reported. As already indicated, Chamaelirium and Aletris are often gathered and mistaken for each other by collectors, but, as will be seen from the preceding description, there is really no excuse for such error.

From the confusion that has existed properties peculiar to the one plant have also been attributed to the other, but it seems now generally agreed that Chamaelirium is of use especially as a tonic in derangements of women.

AMERICAN HELLEBORE.

Veratrum viride Ait.

Pharmacopœial name.—Veratrum.

Other common names.—True veratrum, green veratrum, American veratrum, green hellebore, swamp-hellebore, big hellebore, false hellebore, bear-corn, bugbane, bugwort, devil's-bite, earth-gall, Indian poke, itchweed, tickleweed, duckretter.

Habitat and range.—American hellebore is native in rich wet woods, swamps, and wet meadows, its range extending from Canada, Alaska, and Minnesota south to Georgia.

Description of plant.—Early in spring, usually in company with the skunk-cabbage, the large, bright-green leaves of American hellebore make their way through the soil, their straight, erect leaf spears forming a conspicuous feature of the yet scanty spring vegetation. Later in the season a stout and erect leafy stem is sent up, sometimes growing as tall as 6 feet. It is solid and round, pale green, very leafy, and closely surrounded by the sheathing bases of the leaves, unbranched except in the flowering head. The leaves are hairy, prominently nerved, folded or pleated like a fan. They have no stems, but their bases encircle or sheathe the main stalk, and are very large, especially the lower ones, which are from 6 to 12 inches in length, from 3 to 6 inches in width, and broadly oval. As they approach the top of the plant the leaves become narrower. The flowers, which appear from May to July, are greenish yellow and numerous, and are borne in rather open clusters. American hellebore belongs to the bunchflower family (Melanthiaceæ) and is a perennial.

This species is a very near relative of the European white hellebore (*Veratrum album* L.), and in fact has by some been regarded as identical with it, or at least as a variety of it. It is taller than *V. album* and has narrower leaves and greener flowers. Both species are official in the United States Pharmacopœia.

Description of rootstock.—The fresh rootstock of American hellebore is ovoid or obconical, upright, thick, and fleshy, the upper part of it arranged in layers, the lower part of it more solid, and producing numerous whitish roots from all sides. In the fresh state it has a rather strong, disagreeable odor. As found in commerce, American hellebore rootstock is sometimes entire, but more generally sliced, and is of a light-brown or dark-brown color externally and internally yellowish white; the roots, which are from 4 to 8 inches long, have a shriveled appearance, and are brown or yellowish. There is no odor to the dried rootstock, but when powdered it causes violent sneezing. The rootstock, which has a bitter and very acrid taste, is poisonous.

Collection, prices, and uses.—American hellebore should be dug in autumn after the leaves have died, and washed and carefully dried, either in the whole state or sliced in various ways. It deteriorates with age, and should therefore not be kept longer than a year.

The adulterations sometimes met with are the rootstocks of related plants, and the skunk-cabbage is also occasionally found mixed with it, but this is probably unintentional, as the two plants usually grow close together.

Collectors of American hellebore root receive from about 3 to 10 cents a pound.

American hellebore, official in the United States Pharmacopœia, is an acrid, narcotic poison, and has emetic, diaphoretic, and sedative properties.

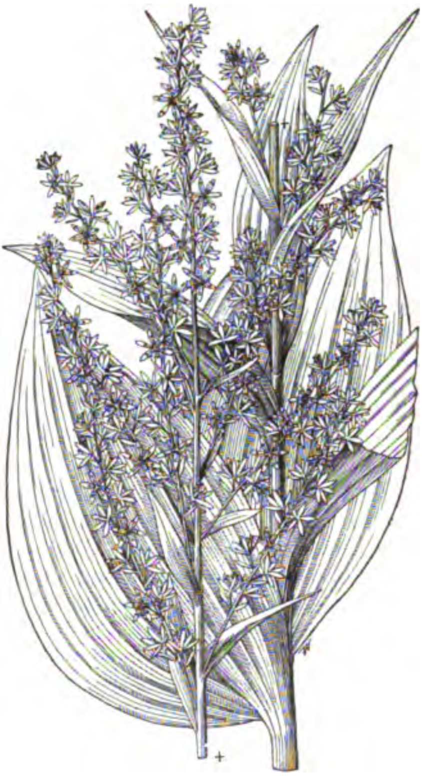

FIG. 3.—American hellebore (*Veratrum viride*).

ALETRIS.

Aletris farinosa L.

Other common names.—Stargrass, blazingstar, mealy starwort, starwort, unicorn-root, true unicorn-root, unicorn-plant, unicorn's-horn, colicroot, devil's-bit, ague-grass, agueroot, aloe-root, crow-corn, huskwort.

A glance at these common names will show many that have been applied to other plants, especially to Chamaelirium, with which Aletris is so much confused. In order to guard against this confusion as much as possible, it is best not to use the common names of this plant at all, referring to it only by its generic name, Aletris.

Habit and range.—Aletris occurs in dry, generally sandy soil, from Maine to Minnesota, Florida, and Tennessee.

Description of plant.—As stated under Chamaelirium, this plant is often confused with the former by collectors and others, although there seems to be no good reason why this should be so. The plants do not resemble each other except in habit of growth (see Pl. II, figs. 1 and 2), and the trouble undoubtedly arose from a confusion of the somewhat similar common names of the plants, as, for instance, "stargrass" and "starwort."

Aletris may be at once distinguished by the grasslike leaves, which spread out on the ground in the form of a star, and by the slender spikes of rough, mealy flowers.

This native perennial, belonging to the lily family (Liliaceæ), is an erect, slender herb, 1½ to 3 feet tall, with basal leaves only. These leaves are grasslike, from 2 to 6 inches long, and have a yellowish green or willow-green color. As already stated, they surround the base of the stem in the form of a star. Instead of stem leaves, there are very small, leaflike bracts placed at some distance apart on the stem. From May to July the erect flowering spike, from 4 to 12 inches long, is produced, bearing white, urn-shaped flowers, sometimes tinged with yellow at the apex, and having a rough, wrinkled and mealy appearance. (Pl. II, fig. 2.) The seed capsule is ovoid, opening by three valves, and containing many seeds. When the flowers in the spike are still in bud, there is a suggestion of resemblance to the female spike of Chamaelirium with its fruit half formed.

Several other species are recognized by botanists, namely, *Aletris aurea* Walt., *A. lutea* Small, and *A. obovata* Nash, but aside from the flowers, which in *aurea* and *lutea* are yellow, and slight variations in form, such as a more contracted perianth, the differences are not so pronounced that the plants would require a detailed description here. They have undoubtedly been collected with *Aletris farinosa* for years, and are sufficiently like it to be readily recognized.

Description of rootstock.—Not only have the plants of Aletris and Chamaelirium been confused, but the rootstocks as well. There is, however, no resemblance between them.

Aletris has a horizontal rootstock from one-half to 1½ inches in length, rough and scaly, and almost completely hidden by the fibrous roots and remains of the basal leaves. Upon close examination the scars of former leaf stems may be seen along the upper surface. The rootlets are from 2 to 10 inches in length, those of recent growth whitish and covered with several layers of epidermis which gradually peel off, and the older rootlets of the rootstock showing this epidermis already scaled off, leaving only the hard, brown, woody center. The rootstock in commerce almost invariably shows at one end a tuft of the remains of the basal leaves, which do not lose their green color. It is grayish brown outside, whitish within, and breaks with a mealy fracture. It has no odor, and a starchy taste, followed by some acridity, *but no bitterness.*

Collection, prices, and uses.—Aletris should be collected in autumn, and there is no reason why collectors should make the common mistake of confusing Aletris with Chamaelirium. By comparing the description of Aletris with that of Chamaelirium, it will be seen that there is scarcely any resemblance. Aletris ranges from 30 to 40 cents a pound.

As indicated under Chamaelirium, the medicinal properties have also been considered the same in both plants, but Aletris is now regarded of value chiefly in digestive troubles. Aletris was official in the United States Pharmacopœia from 1820 to 1870.

BETHROOT.

Trillium erectum L.

Other common names.—Trillium, red trillium, purple trillium, ill-scented trillium, birthroot, birthwort, bathwort, bathflower, red wake-robin, purple wake-robin, ill-scented wake-robin, red-benjamin, bumblebee-root, daffydown-dilly, dishcloth, Indian balm, Indian shamrock, nosebleed, squawflower, squawroot, wood-lily, true-love, orange-blossom. Many of these names are applied also to other species of Trillium.

Habitat and range.—Bethroot is a native plant growing in rich soil in damp, shady woods from Canada south to Tennessee and Missouri.

Description of plant.—This plant is a perennial belonging to the lily-of-the-valley family (Convallariaceæ). It is a low growing plant, from about 8 to 16 inches in height, with a rather stout stem, having three leaves arranged in a whorl near the top. These leaves are broadly ovate, almost circular in outline, sharp pointed at the apex and narrowed at the base, 3 to 7 inches long and about as wide, and practically stemless.

Not only the leaves of this plant, but the flowers and parts of the flowers are arranged in threes, and this feature will serve to identify the plant. (Pl. I, fig. 4.) The solitary terminal flower of bethroot has three sepals and three petals, both more or less lance shaped and spreading, the former greenish, and the petals, which are 1¼ inches long and one-half inch wide, are sometimes dark purple, pink, greenish, or white. The flower has an unpleasant odor. It appears from April to June and is followed later in the season by an oval, reddish berry.

Various other species of Trillium are used in medicine, possessing properties similar to those of the species under consideration. These are also very similar in appearance to *Trillium erectum*.

Description of root.—Bethroot (Pl. I, fig. 4), as found in the stores, is short and thick, of a light-brown color externally, whitish or yellowish inside, somewhat globular or oblong in shape, and covered all around with numerous pale-brown, shriveled rootlets. The top of the root generally shows a succession of fine circles or rings, and usually bears the remains of stem bases.

The root has a slight odor, and is at first sweetish and astringent, followed by a bitter and acrid taste. When chewed it causes a flow of saliva.

Collection, prices, and uses.—Bethroot is generally collected toward the close of summer. The price ranges from 7 to 10 cents a pound.

It was much esteemed as a remedy among the Indians and early settlers. Its present use is that of an astringent, tonic, and alterative, and also that of an expectorant.

WILD YAM.

Dioscorea villosa L.

Other common names.—Dioscorea, colicroot, rheumatism-root, devil's-bones.

Habitat and range.—Wild yam grows in moist thickets, trailing over adjacent shrubs and bushes, its range entending from Rhode Island to Minnesota, south to Florida and Texas. It is most common in the central and southern portions of the United States.

Description of plant.—This native perennial vine is similar to and belongs to the same family as the well-known cinnamon vine of the gardens—namely, the yam family (Dioscoreaceæ). It attains a length of about 15 feet, the stem smooth, the leaves heart shaped and 2 to 6 inches long by 1 to 4 inches wide.

The leaves, which are borne on long, slender stems, are thin, green, and smooth on the upper surface, paler and rather thickly hairy on the under surface. The small greenish yellow flowers are produced from June to July, the male flowers borne in drooping clusters about 3 to 6 inches long, and the female flowers in drooping spikelike heads. The fruit, which is in the form of a dry, membranous, 3-winged, yellowish green capsule, ripens about September and remains on the vine for some time during the winter. (Pl. II, fig. 3.)

Growing farther south than the species above mentioned is a variety for which the name *glabra* has been suggested.

According to C. G. Lloyd (King's American Dispensatory, Vol. I, 1898), there is a variety of *Dioscorea villosa* the root of which first made its appearance among the true yam roots of commerce, and which was so different in form that it was rejected as an adulteration. The plant, however, from which the false root was derived was found upon investigation to be almost identical with the true yam, except that the leaves were perfectly smooth, lacking the hairiness on the under surface of the leaf which is characteristic of the true wild yam. The false variety also differs in its habit of growth, not growing in dense clumps like the true wild yam, but generally isolated. The root of the variety, however, is quite distinct from that of the true wild yam, being much more knotty. Lloyd states further that the hairiness or lack of hairiness on the under side of the leaf is a certain indication as to the form of the root.

Lloyd, recognizing the necessity of classifying these two yam roots of commerce, has designated the smooth-leaved variety as *Dioscorea villosa* var. *glabra.*

Description of rootstocks.—The rootstock of the true wild yam (Pl. II, fig. 3) runs horizontally underneath the surface of the ground. As found in commerce, it consists of very hard pieces, 6 inches and sometimes 2 feet in length, but only about one-fourth or one-half of an inch in diameter, twisted, covered with a thin brown bark, whitish within, and showing stem scars almost an inch apart on the upper surface, small protuberances on the sides, and numerous rather wiry rootlets on the lower surface.

The false wild yam, on the other hand, has a much heavier, rough, knotty rootstock, with thick branches from 1 inch to 3 inches long, the upper surface covered with crowded stem scars and the lower side furnished with stout wiry rootlets. Within it is similar to the true yam root.

Collection, prices, and uses.—The roots are generally collected in autumn, and bring from 2½ to 4 cents a pound. Wild yam is said to possess expectorant properties and to promote perspiration, and in large doses proving emetic. It has been employed in bilious colic, and by the negroes in the South in the treatment of muscular rheumatism.

BLUE FLAG.

Iris versicolor L.

Other common names.—Iris, flag-lily, liver-lily, snake-lily, poison-flag, water-flag, American fleur-de-lis or flower-de-luce.

Habitat and range.—Blue flag delights in wet, swampy localities, making its home in marshes, thickets, and wet meadows from Newfoundland to Manitoba, south to Florida and Arkansas.

Description of plant.—The flowers of all of the species belonging to this genus are similar, and are readily recognized by their rather peculiar form, the three outer segments or parts reflexed or turned back and the three inner segments standing erect.

Blue flag is about 2 to 3 feet in height, with an erect stem sometimes branched near the top, and sword-shaped leaves which are shorter than the stem, from one-half to 1 inch in width, showing a slight grayish "bloom," and sheathing at the base. This plant is a perennial belonging to the iris family (Iridaceæ), and is a native of this country. June is generally regarded as the month for the flowering of the blue flag, although it may be said to be in flower from May to July, depending on the locality. The flowers are large and very handsome, each stem bearing from two to six or more. They consist of six segments or parts, the three outer ones turned back and the three inner ones erect and much smaller. (Pl. II, fig. 4.) The flowers are usually purplish blue, the "claw," or narrow base of the segments, variegated with yellow, green, or white and marked with purple veins.

All of the species belonging to this genus are more or less variegated in color; hence the name "iris," meaning "rainbow," and the specific name "versicolor," meaning "various colors." The name "poison-flag" has been applied to it on account of the poisonous effect it has produced in children, who, owing to the close resemblance of the plants before reaching the flowering stage, sometimes mistake it for sweet-flag.

The seed capsule is oblong, about 1½ inches long, and contains numerous seeds.

Description of rootstock.—Blue flag has a thick, fleshy, horizontal rootstock, branched, and producing long fibrous roots. (Pl. II, fig. 4.) It resembles sweet-flag (Calamus), and has been mistaken for it. The sections of the rootstock of blue flag, however, are flattened above and rounded below; the scars of the leaf sheaths are in the form of rings, whereas in sweet-flag the rootstock is cylindrical and the scars left by the leaf sheaths are obliquely transverse. Furthermore, there is a difference in the arrangement of the roots on the rootstock, the scars left by the roots in blue flag being close together generally nearer the larger end, while in sweet-flag the disposition of the roots along the rootstock is quite regular. Blue flag is grayish brown on the outside when dried, and sweet-flag is light brown or fawn colored. Blue flag has no well-marked odor, and the taste is acrid and nauseous, and in sweet-flag there is a pleasant odor and bitter, pungent taste.

Collection, prices, and uses.—Blue flag is collected in autumn, and usually brings from about 7 to 10 cents a pound. Great scarcity of blue flag root was reported from the producing districts in the autumn of 1906. It is an old remedy, the Indians esteeming it highly in stomach troubles, and it is said that it was sometimes cultivated by them in near-by ponds on account of its medicinal value. It has also been used as a domestic remedy, and is regarded as an alterative, diuretic, and purgative. It was official in the United States Pharmacopœia of 1890.

LADY'S-SLIPPER.

(1) *Cypripedium hirsutum* Mill. and (2) *Cypripedium parviflorum* Salisb.

Synonym.—(1) *Cypripedium pubescens* Willd.

Pharmacopœial name.—Cypripedium.

Other common names.—(1) Large yellow lady's-slipper, yellow lady's-slipper, yellow moccasin-flower, Venus'-shoe, Venus'-cup, yellow Indian-shoe, American valerian, nerve-root, male nervine, yellow Noah's-ark, yellows, monkey-flower, umbil-root, yellow umbil; (2) small yellow lady's-slipper.

Habitat and range.—Both of these native species frequent bogs and wet places in deep shady woods and thickets. The large yellow lady's-slipper may be found from Nova Scotia south to Alabama and west to Nebraska and Missouri. The range for the small yellow lady's-slipper extends from Newfoundland south along the mountains to Georgia, and west to Missouri, Washington, and British Columbia.

Description of plants.—The orchid family (Orchidaceæ), to which the lady's-slippers belong, boasts of many beautiful, showy, and curious species, and the lady's-slipper is no exception. There are several other plants to which the name lady's-slipper has been applied, but one glance at the peculiar structure of the flowers in the species under consideration, as shown in the illustration (Pl. III, fig. 1), will enable anyone to recognize them as soon as seen.

The particular species of lady's-slipper under consideration in this article do not differ very materially from each other. Both are perennials, growing from

1 to about 2 feet in height, with rather large leaves and with yellow flowers more or less marked with purple, the main difference being that in *hirsutum* the flower is larger and pale yellow, while in *parviflorum* the flower is small, bright yellow, and perhaps more prominently striped and spotted with purple. The stem, leaves, and inside of corolla or lip are somewhat hairy in the large yellow lady's-slipper, but not in the small yellow lady's-slipper. These hairs are said to be irritating to some people, in whom they cause an eruption of the skin.

The leaves of the lady's-slipper vary in size from 2 to 6 inches in length and from 1 to 3 inches in width, and are broadly oval or elliptic, sharp pointed, with numerous parallel veins, and sheathing at the base. somewhat hairy in the large lady's-slipper. The solitary terminal flower, which appears from May to June, is very showy and curiously formed, the lip being the most prominent part. This lip looks like an inflated bag (1 to 2 inches long in the large lady's-slipper), pale yellow or bright yellow in color, variously striped and blotched with purple. The other parts of the flower are greenish or yellowish, with purple stripes, and the petals are usually twisted.

Description of rootstock.—The rootstock is of horizontal growth, crooked, fleshy, and with numerous wavy, fibrous roots. (Pl. III, fig. 1.) As found in commerce, the rootstocks are from 1 to 4 inches in length, about an eighth of an inch in thickness, dark brown, the upper surface showing numerous round cup-shaped scars, the remains of former annual stems, and the lower surface thickly covered with wavy, wiry, and brittle roots, the latter breaking off with a short, white fracture. The odor is rather heavy and disagreeable, and the taste is described as sweetish, bitter, and somewhat pungent.

Collection, prices, and uses.—Both rootstock and roots are used, and these should be collected in autumn, freed from dirt, and carefully dried in the shade. These beautiful plants are becoming rare in many localities. Sometimes such high-priced drugs as goldenseal and senega are found mixed with the lady's-slipper, but as these are more expensive than the lady's-slipper, it is not likely that they are included with fraudulent intent, and they can be readily distinguished. The prices paid to collectors of this root range from 32 to 35 cents a pound.

The principal use of lady's-slipper, which is official in the United States Pharmacopœia, is as an antispasmodic and nerve tonic, and it has been used for the same purposes as valerian.

CRAWLEY-ROOT.

Corallorhiza odontorhiza (Willd.) Nutt.

Other common names.—Corallorhiza, crawley, coralroot, small coralroot, small-flowered coralroot, late coralroot, dragon's-claw, chickentoe, turkey-claw, feverroot.

Habitat and range.—Rich, shady woods having an abundance of leaf mold produce this curious little plant. It may be found in such situations from Maine to Florida, westward to Michigan and Missouri.

Description of plant.—This peculiar native perennial, belonging to the orchid family (Orchidaceæ), is unlike most other plants, being leafless, and instead of a green stem it has a purplish brown, sheathed scape, somewhat swollen or bulbous at the base and bearing a clustered head of purplish flowers 2 to 4 inches long. It does not grow much taller than about a foot in height. (Fig. 4.)

The flowers, 6 to 20 in a head, appear from July to September, and consist of lance-shaped sepals and petals striped with purple and a broad, whitish, oval lip, generally marked with purple and narrowed at the base. The seed capsule is large, oblong, or somewhat globular.

Description of rootstock.—The rootstock of this plant is also curious, resembling in its formation a piece of coral (fig. 4), on account of which it is known by the name "coralroot." The other common names, such as chickentoe, turkey-claw, etc., all have reference to the form of the rootstock. As found in commerce, crawley-root consists of small, dark-brown wrinkled pieces, the larger ones branched like coral. The taste at first is sweetish, becoming afterwards slightly bitter. It has a peculiar odor when fresh, but when dry it is without odor.

Collection, prices, and uses.—Crawley-root should be collected in July or August. The price ranges from 20 to 50 cents a pound. Other species of Corallorhiza are sometimes collected and are said to probably possess similar properties. This root is said to be very effective for promoting perspiration, and it is also used as a sedative and in fever.

CANADA SNAKEROOT.

Asarum canadense L.

Other common names.—Asarum, wild ginger, Indian ginger, Vermont snakeroot, heart-snakeroot, southern snakeroot, black snakeroot, colt's-foot snakeroot, black snakeweed, broad-leaved asarabacca, false colt's-foot, cat's-foot, colicroot.

Habitat and range.—This inconspicuous little plant frequents rich woods or rich soil along roadsides from Canada south to North Carolina and Kansas.

Description of plant.—Canada snakeroot is a small, apparently stemless perennial, not more than 6 to 12 inches in height, and belongs to the birthwort family (Aristolochiaceæ). It usually has but two leaves, which are borne on slender, finely hairy stems; they are kidney shaped or heart shaped, thin, dark green above and paler green on the lower surface, strongly veined, and from 4 to 7 inches broad. The solitary bell-shaped flower is of an unassuming dull brown or brownish purple, and this modest color, together with its position on the plant, renders it so inconspicuous as to escape the notice of the casual observer. It droops from a short, slender stalk produced between the two leaf stems and is almost hidden under the two leaves, growing so close to the ground that it is sometimes buried beneath old leaves, and sometimes the soil must be removed before the flower can be seen. It is bell shaped, woolly, the inside darker in color than the outside and of a satiny texture. The fruit which follows is in the form of a leathery 6-celled capsule. (Pl. III, fig. 2.)

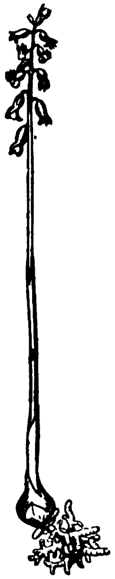

FIG. 4.—Crawley-root (*Corallorhiza odontorhiza*). After Torrey's Flora of New York.

Description of rootstock.—Canada snakeroot has a creeping, yellowish rootstock, slightly jointed, with thin rootlets produced from joints which occur about every half inch or so. (Pl. III, fig. 2.) In the drug trade the rootstock is usually found in pieces a few inches in length and about one-eighth of an inch in diameter. These are four-angled, crooked, brownish and wrinkled on the outside, whitish inside and showing a large central pith, hard and brittle, and breaking with a short fracture. The odor is fragrant and the taste spicy and aromatic, and has been said to be intermediate between ginger and serpentaria.

Collection, prices, and uses.—The aromatic root of Canada snakeroot is collected in autumn, and the price ranges from 10 to 15 cents a pound. It was reported as very scarce in the latter part of the summer of 1906. Canada snakeroot, which was official in the United States Pharmacopœia from 1820 to 1880, is used as an aromatic, diaphoretic, and carminative.

SERPENTARIA.

(1) *Aristolochia serpentaria* L. and (2) *Aristolochia reticulata* Nutt.

Pharmacopœial name.—Serpentaria.

Other common names.—(1) Virginia serpentaria, Virginia snakeroot, serpentary, snakeweed, pelican-flower, snagrel, sangrel, sangree-root; (2) Texas serpentaria, Texas snakeroot, Red River snakeroot.

Habitat and range.—Virginia serpentaria is found in rich woods from Connecticut to Michigan and southward, principally along the Alleghenies, and Texas serpentaria occurs in the Southwestern States, growing along river banks from Arkansas to Louisiana.

Description of Virginia serpentaria.—About midsummer the queerly shaped flowers of this native perennial are produced. They are very similar to those of the better known "Dutchman's-pipe," another species of this genus, which is quite extensively grown as an ornamental vine for covering porches and trellises. Virginia serpentaria and Texas serpentaria both belong to the birthwort family (Aristolochiaceæ). The Virginia serpentaria is nearly erect, the slender, wavy stem sparingly branched near the base, and usually growing to about a foot in height, sometimes, however, even reaching 3 feet. The leaves are thin, ovate, ovate lance shaped or oblong lance shaped, and usually heart shaped at the base; they are about 2½ inches long and about 1 or 1½ inches in width. The flowers are produced from near the base of the plant, similar to its near relative, the Canada snakeroot. They are solitary and terminal, borne on slender, scaly branches, dull brownish purple in color, and of a somewhat leathery texture; the calyx tube is curiously bent or contorted in the shape of the letter S. The fruit is a roundish 6-celled capsule, about half an inch in diameter, and containing numerous seeds. (Pl. III, fig. 3.)

Description of Texas serpentaria.—This species has a very wavy stem, with oval, heart-shaped, clasping leaves, which are rather thick and strongly reticulated or marked with a network of veins; hence the specific name *reticulata*. The entire plant is hairy, with numerous long, coarse hairs. The small, densely hairy purplish flowers are also produced from the base of the plant.

Description of rootstocks.—Serpentaria has a short rootstock with many thin, branching, fibrous roots. (Pl. III, fig. 3.) In the dried state it is thin and bent, the short remains of stems showing on the upper surface and the under surface having numerous thin roots about 4 inches in length, all of a dull yellowish brown color, internally white. It has a very agreeable aromatic odor, somewhat like camphor, and the taste is described as warm, bitterish, and camphoraceous.

The Texas serpentaria has a larger rootstock, with fewer roots less interlaced than the Virginia serpentaria.

Collection, prices, and uses.—The roots of serpentaria are collected in autumn. Various other roots are sometimes mixed with serpentaria, but as they are mostly high-priced drugs, such as goldenseal, pinkroot, senega, and ginseng, their presence in a lot of serpentaria is probably accidental, due simply to proximity of growth of these plants. Abscess-root (*Polemonium reptans* L.) is another root with which serpentaria is often adulterated. It is very similar to serpentaria, except that it is nearly white. The price of serpentaria ranges from 35 to 40 cents a pound.

Serpentaria is used for its stimulant, tonic, and diaphoretic properties. Both species are official in the United States Pharmacopœia.

YELLOW DOCK.

Rumex crispus L.

Other common names.—Rumex, curled dock, narrow dock, sour dock. (Fig. 5.)

Habitat and range.—This troublesome weed, introduced from Europe, is now found throughout the United States, occurring in cultivated as well as in waste ground, among rubbish heaps, and along roadsides.

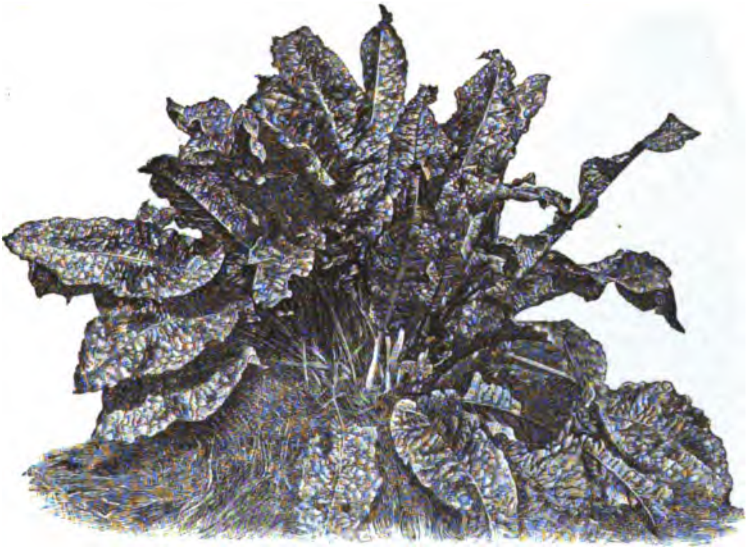

FIG. 5.—Yellow dock (*Rumex crispus*), first year's growth.

Description of plant.—Yellow dock is a perennial plant belonging to the buckwheat family (Polygonaceæ), and has a deep, spindle-shaped root, from which arises an erect, angular, and furrowed stem, attaining a height of from 2 to 4 feet. The stem is branched near the top and leafy, bearing numerous long dense clusters formed by drooping groups of inconspicuous green flowers placed in circles around the stem. The flowers are produced from June to August, and the fruits which follow are in the form of small triangular nuts, like the grain of buckwheat, to which family the dock belongs. So long as the fruits are green and immature they can scarcely be distinguished from the flowers, but as they ripen the clusters take on a rusty-brown color. The leaves of the yellow dock are lance shaped, acute, with the margins strongly waved and crisped, the lower long-stalked leaves being blunt or heart shaped at the base and from 6 to 8 inches in length, while those nearer the top are narrower and shorter, only 3 to 6 inches in length, short stemmed or stemless.

The broad-leaved dock (*Rumex obtusifolius* L.), known also as bitter dock, common dock, blunt-leaved dock, and butter-dock, is a very common weed found in waste places from the New England States to Oregon and south to Florida and Texas. It grows to about the same height as the yellow dock, to which it bears a close resemblance, differing principally in its more robust habit of growth. The stem is stouter than in yellow dock, and the leaves, which like-

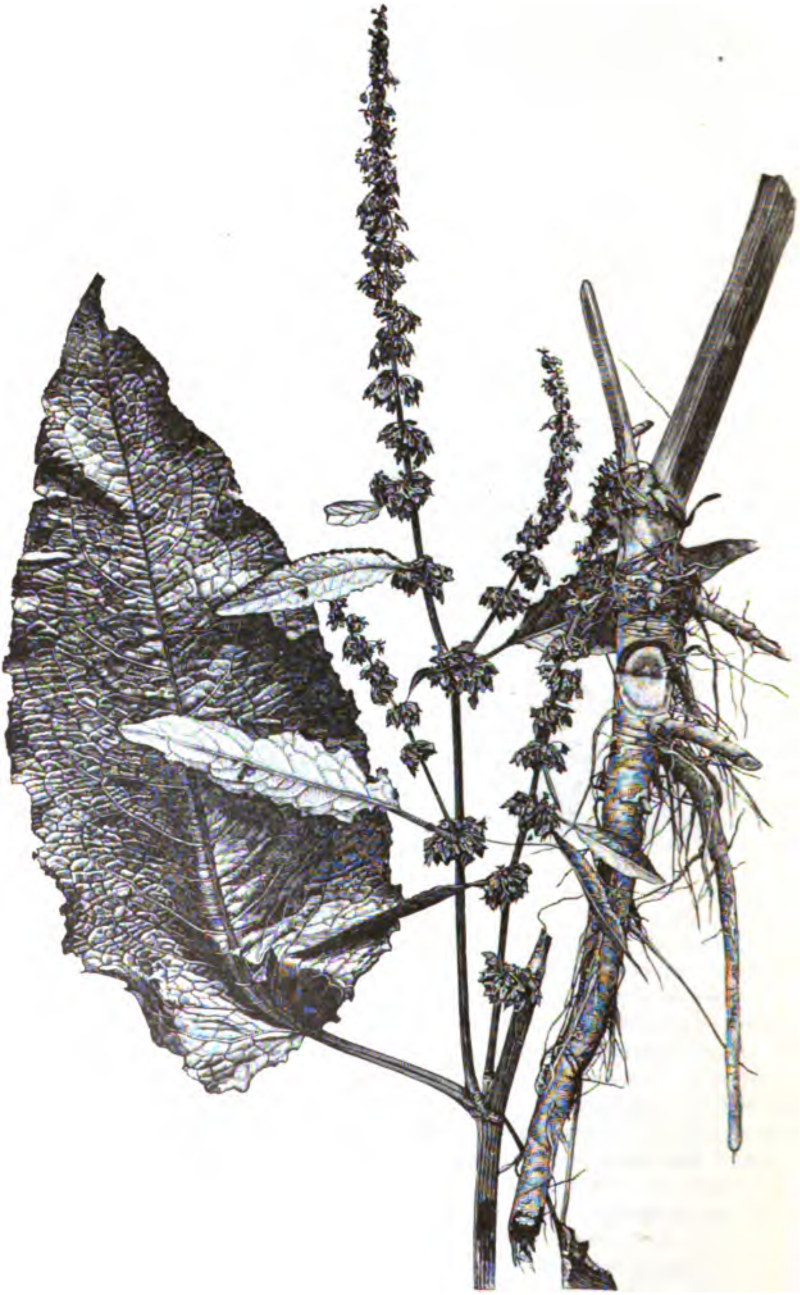

FIG. 6.—Broad-leaved dock (*Rumex obtusifolius*), leaf, fruiting spike, and root.

wise are wavy along the margin, are much broader and longer. The green flowers appear from June to August and are in rather long, open clusters, the groups rather loose and far apart. (Fig. 6.)

Description of roots.—Yellow dock root is large and fleshy, usually from 8 to 12 inches long, tapering or spindle shaped, with few or no rootlets. When dry it is usually twisted and prominently wrinkled, the rather thick, dark, reddish brown bark marked with small scars. The inside of the root is whitish at first, becoming yellowish. The fracture is short, but shows some splintery fibers. The root, as it occurs in commerce, is either entire or occasionally split lengthwise.

The darker colored root of the broad-leaved dock has a number of smaller branches near the crown and more rootlets. (Fig. 6.) Dock roots have but a very faint odor and a bitter, astringent taste.

Collection, prices, and uses.—The roots should be collected in late summer or autumn, after the fruiting tops have turned brown, then washed, either left entire or split lengthwise into halves or quarters, and carefully dried. Yellow dock root ranges from 4 to 6 cents a pound.

In the United States Pharmacopœia of 1890 "the roots of *Rumex crispus* and of some other species of Rumex" were official, and both of the above-named species are used, but the yellow dock (*Rumex crispus*) is the species most commonly employed in medicine. The docks are largely used for purifying the blood and in the treatment of skin diseases.

The young root leaves of both of the species mentioned are sometimes used in spring as pot herbs.

POKEWEED.

Phytolacca decandra L.[a]

Synonym.—*Phytolacca americana* L.[a]

Pharmacopœial name.—Phytolacca.

Other common names.—Poke, pigeon-berry, garget, scoke, pocan, coakum, Virginian poke, inkberry, red inkberry, American nightshade, cancer-jalap, redweed.

Habitat and range.—Pokeweed, a common, familiar, native weed, is found in rich, moist soil along fence rows, fields, and uncultivated land from the New England States to Minnesota south to Florida and Texas.

Description of plant.—In Europe, where pokeweed has become naturalized from this country, it is regarded as an ornamental garden plant, and, indeed, it is very showy and attractive with its reddish purple stems, rich green foliage, and clusters of white flowers and dark-purple berries.

The stout, smooth stems, arising from a very large perennial root, attain a height of from 3 to 9 feet, and are erect and branched, green at first, then reddish. If a piece of the stem is examined, the pith will be seen to be divided into disk-shaped parts with hollow spaces between them. The smooth leaves are borne on short stems and are about 5 inches long and 2 to 3 inches wide, ovate or ovate oblong, acute at the apex, and the margins entire. The long-stalked clusters of whitish flowers, which appear from July to September, are from 3 to 4 inches in length, the flowers numerous and borne on reddish stems. In about two months the berries will have matured and assumed a rich dark-purple color.

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[a] *Phytolacca americana* L. by right of priority should be accepted, but *P. decandra* L. is used in conformity with the Pharmacopœia.

These smooth and shining purple berries are globular, flattened at both ends, and contain black seeds embedded in a rich crimson juice. (Fig. 7.) This plant belongs to the pokeweed family (Phytolaccaceæ).

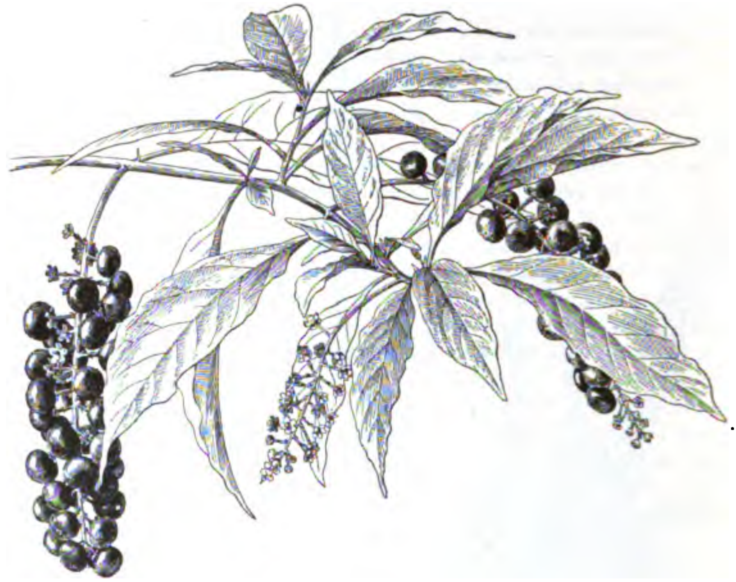

FIG. 7.—Pokeweed (*Phytolacca decandra*), flowering and fruiting branch.

Description of root.—Pokeweed has a very thick, long, fleshy root, conical in shape and branched (fig. 8), very much resembling that of horseradish, and poisonous. In commerce it usually occurs in transverse or lengthwise slices, the outside a yellowish brown and finely wrinkled lengthwise, and thickly encircled with lighter colored ridges. It breaks with a fibrous fracture and is yellowish gray within. The transverse slices show many concentric rings. There is a slight odor and the taste is sweetish and acrid. The root when powdered causes sneezing.

Collection, prices, and uses.—The root of the pokeweed, which is official in the United States Pharmacopœia, is collected in the latter part of autumn, thoroughly cleaned, cut into transverse or lengthwise slices, and carefully dried. It brings from 2½ to 4 cents a pound.

The root is used for its alterative properties in treating various diseases of the skin and blood, and in certain cases in relieving pain and allaying inflammation. It also acts upon the bowels and causes vomiting.

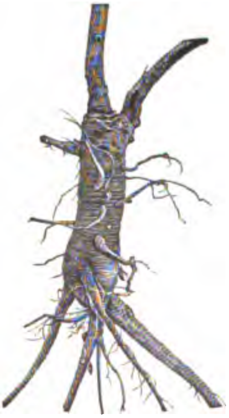

FIG. 8.—Pokeweed root.

The berries when fully matured are also used in medicine.

The young and tender shoots of the pokeweed are eaten in spring, like asparagus, but bad results may follow if they are not thoroughly cooked or if they are cut too close to the root.

SOAPWORT.

Saponaria officinalis L.

Other common names.—Saponaria, saponary, common soapwort, bouncing-bet, soaproot, bruisewort, Boston pink, chimney-pink, crow-soap, hedge-pink, old-maid's-pink, fuller's-herb, lady-by-the-gate, London-pride, latherwort, mock-gilliflower, scourwort, sheepweed, sweet-betty, wild sweet-william, woods-phlox, world's-wonder.

Habitat and range.—By one or another of its many common names this plant, naturalized from Europe, is known almost everywhere, occurring along roadsides and in waste places.

Description of plant.—Soapwort is a rather pretty herbaceous perennial, 1 to 2 feet high, and belonging to the pink family (Silenaceæ). Its smooth, stout, and erect stem is leafy and only sparingly branched, the leaves ovate, 2 to 3 inches long, smooth, prominently ribbed, and pointed at the apex. The bright-looking, crowded clusters of pink (or in shady localities whitish) flowers appear from about June until far along in September. The five petals of the corolla are furnished with long "claws," or, in other words, they are narrowly lengthened toward the base and inserted within the tubular and pale-green calyx. The seed capsule is oblong and one-celled. (Pl. III, fig. 4.)

Description of root.—Soapwort spreads by means of its stolons, or underground runners. But the roots, which are rather long, are the parts employed in medicine. These are cylindrical, tapering toward the apex, more or less branched, and wrinkled lengthwise. (Pl. III, fig. 4.) The whitish wood is covered with a brownish red, rather thick bark, and the root breaks with a short, smooth fracture. It is at first sweetish, bitter, and mucilaginous, followed by a persistently acrid taste, but it has no odor.

Collection, prices, and uses.—As already indicated, the roots, without the runners, should be collected either in spring or autumn. With water they form a lather, like soap, whence the common names soapwort, soaproot, latherwort, etc., are derived. The price ranges from 5 to 10 cents a pound. The roots are employed in medicine for their tonic, alterative, and diaphoretic properties. The leaves are also used.

GOLDENSEAL.

Hydrastis canadensis L.

Pharmacopœial name.—Hydrastis.

Other common names.—Yellowroot, yellow puccoon, orange-root, yellow Indian-paint, turmeric-root, Indian turmeric, Ohio curcuma, ground-raspberry, eye-root, eye-balm, yellow-eye, jaundice-root, Indian-dye.

Habitat and range.—This native forest plant occurs in patches in high, open woods, and usually on hillsides or bluffs affording natural drainage, from southern New York to Minnesota and western Ontario, south to Georgia and Missouri.

Goldenseal is now becoming scarce throughout its range. Ohio, Indiana, Kentucky, and West Virginia have been the greatest goldenseal-producing States.

Description of plant.—Goldenseal is a perennial plant belonging to the same family as the buttercup, namely, the crowfoot family (Ranunculaceæ). It has a thick yellow rootstock, which sends up an erect hairy stem about 1 foot in height, surrounded at the base by 2 or 3 yellowish scales. The yellow color of the roots and scales extends up the stem so far as it is covered by soil, while the portion of the stem above ground has a purplish color. The stem, which has only two leaves, seems to fork at the top, one branch bearing a large leaf and the other a smaller one and a flower. A third leaf, which is much smaller than the other two and stemless, is occasionally produced. The leaves are palmately 5 to 9 lobed, the lobes broad, acute, sharply and unequally toothed; they are prominently veined on the lower surface, and at flowering time, when they are very much wrinkled, they are only partially developed, but they continue to expand until they are from 6 to 8 inches in diameter, becoming thinner in texture and smoother. The upper leaf subtends or incloses the flower bud. The greenish white flower appears about April or May, but it is of short duration, lasting only five or six days. It is less than half an inch in diameter and, instead of petals, has three small petal-like sepals, which fall away as soon as the flower expands, leaving only the numerous stamens (as many as 40 or 50), in the center of which are about a dozen pistils, which finally develop into a round, fleshy, berry-like head which ripens in July or August. The fruit when ripe turns a bright red and resembles a large raspberry, whence the common name "ground-raspberry" is derived. It contains from 10 to 20 small, black, shining, hard seeds. (Fig. 9.)

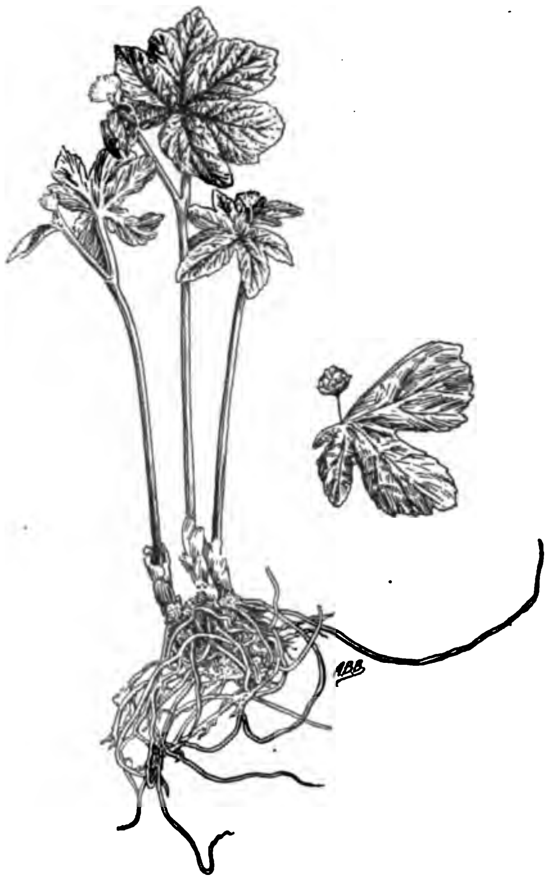

FIG. 9.—Goldenseal (*Hydrastis canadensis*), flowering plant and fruit.

Description of rootstock.—The fresh rootstock of goldenseal, which has a rank, nauseating odor, is bright yellow, both internally and externally, with fibrous yellow rootlets produced from the sides. It is from 1½ to 2½ inches in length, from one-fourth to three-fourths of an inch in thickness, and contains a large amount of yellow juice. (Fig. 10.)

In the dried state the rootstock is crooked, knotty, and wrinkled, from 1 to 2 inches in length, and from one-eighth to one-third of an inch in diameter. It is of a dull-brown color on the outside and breaks with a clean, short, resinous fracture, showing a lemon-yellow color inside. After the rootstock has been kept for some time it will become greenish yellow or brown internally and its quality impaired. The cup-like depressions or stem scars on the upper surface of the rootstock resemble the imprint of a seal, whence the most popular name of the plant, goldenseal, is derived. The rootstock as found in commerce is almost bare, the fibrous rootlets, which in drying become very wiry and brittle, breaking off readily and leaving only small protuberances.

The odor of the dried rootstock, while not so pronounced as in the fresh material, is peculiar, narcotic, and disagreeable. The taste is exceedingly bitter, and when the rootstock is chewed there is a persistent acridity, which causes an abundant flow of saliva.

Collection, prices, and uses.—The root should be collected in autumn after the seeds have ripened, freed from soil, and carefully dried. After a dry season goldenseal dies down soon after the fruit is mature, so that it often happens that by the end of September not a trace of the plant remains above ground; but if the season has been moist, the plant sometimes persists to the beginning of winter. The price of goldenseal ranges from $1 to $1.50 a pound.

Goldenseal, which is official in the United States Pharmacopœia, is a useful drug in digestive disorders and in certain catarrhal affections of the mucous membranes, in the latter instance being administered both internally and locally.

Cultivation.—Once so abundant in certain parts of the country, especially in the Ohio Valley, goldenseal is now becoming scarce throughout its range, and in consequence of the increased demand for the root, both at home and abroad, its cultivation must sooner or later be more generally undertaken in order to satisfy the needs of medicine. In some parts of the country the cultivation of goldenseal is already under way.

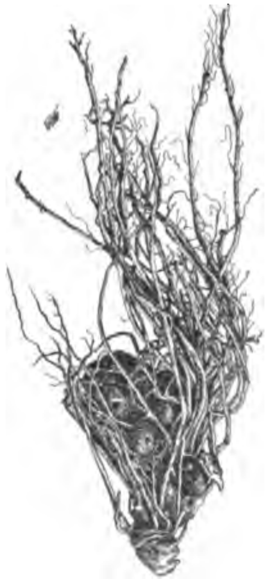

FIG. 10.—Goldenseal rootstock.

The first thing to be considered in growing this plant is to furnish it, as nearly as possible, the conditions to which it has been accustomed in its native forest home. This calls for a well-drained soil, rich in humus, and partially shaded. Goldenseal stands transplanting well, and the easiest way to propagate it is to bring the plants in from the forest and transplant them to a properly prepared location, or to collect the rootstocks and to cut them into as many pieces as there are buds, planting these pieces in a deep, loose, well-prepared soil, and mulching, adding new mulch each year to renew the humus. With such a soil the cultivation of goldenseal is simple, and it will be necessary chiefly to keep down the weeds.

The plants may be grown in rows 1 foot apart and 6 inches apart in the row, or they may be grown in beds 4 to 8 feet wide, with walks between. Artificial shade will be necessary, and this is supplied by the erection of lath sheds. The time required to obtain a marketable crop is from two to three years.

Detailed information regarding the experiments made by the Department will be found in another publication.[a]

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[a] Bulletin 51, Part VI, Bureau of Plant Industry, "Goldenseal."

DEC 30 1907

GOLDTHREAD.

Coptis trifolia (L.) Salisb.

Other common names.—Coptis, cankerroot, mouthroot, yellowroot.

Habitat and range.—This pretty little perennial is native in damp, mossy woods and bogs from Canada and Alaska south to Maryland and Minnesota. It is most common in the New England States, northern New York and Michigan, and in Canada, where it frequents the dark sphagnum swamps, cold bogs, and the shade of dense forests of cedars, pines, and other evergreens.

Description of plant.—Anyone familiar with this attractive little plant will agree that it is well named. The roots of goldthread, running not far beneath the surface of the ground, are indeed like so many tangled threads of gold. The plant in the general appearance of its leaves and flowers very closely resembles the strawberry plant. It is of low growth, only 3 to 6 inches in height, and belongs to the crowfoot family (Ranunculaceæ). The leaves are all basal, and are borne on long, slender stems; they are evergreen, dark green and shining on the upper surface and lighter green beneath, divided into three parts, which are prominently veined and toothed. A single small, white, star-shaped flower is borne at the ends of the flowering stalks, appearing from May to August. (Fig. 11.) The 5 to 7 sepals or lobes of the calyx are white and like petals, and the petals of the corolla, 5 to 7 in number, are smaller, club shaped, and yellow at the base. The seed pods are stalked, oblong, compressed, spreading, tipped with the persistent style, and containing small black seeds.

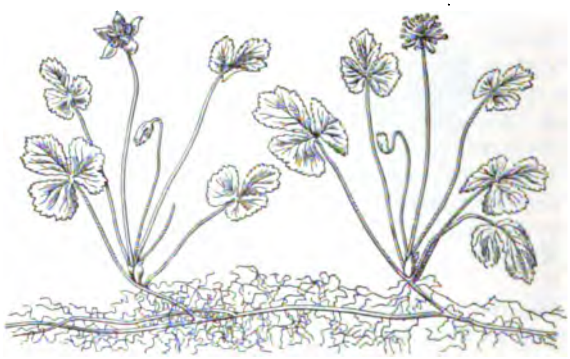

FIG. 11.—Goldthread (*Coptis trifolia*). After Lloyd's Drugs and Medicines of North America.

Description of root.—Goldthread has a long, slender, creeping root, which is much branched and frequently matted. (Fig. 11.) The color of these roots is a bright golden yellow. As found in the stores, goldthread consists usually of tangled masses of these golden-yellow roots, mixed with the leaves and stems of the plant, but the root is the part prescribed for use. The root is bitter and has no odor.

Collection, prices, and uses.—The time for collecting goldthread is in autumn. After removing the covering of dead leaves and moss, the creeping yellow roots of goldthread will be seen very close to the surface of the ground, from which they can be very easily pulled. They should, of course, be carefully dried. As already stated, although the roots and rootlets are the parts to be used, the commercial article is freely mixed with the leaves and stems of the plant. Evidences of the pine-woods home of this plant, in the form of pine needles and bits of moss, are often seen in the goldthread received for market. Goldthread brings from 60 to 70 cents a pound.

The Indians and early white settlers used this little root as a remedy for various forms of ulcerated and sore mouth, and it is still used as a wash or gargle for affections of this sort. It is also employed as a bitter tonic.

Goldthread was official in the United States Pharmacopœia from 1820 to 1880.

BLACK COHOSH.

Cimicifuga racemosa (L.) Nutt.

Synonym.—*Actaea racemosa* L.

Pharmacopœial name.—Cimicifuga.

Other common names.—Black snakeroot, bugbane, bugwort, rattle-snakeroot, rattleroot, rattleweed, rattletop, richweed, squawroot.

Habitat and range.—Although preferring the shade of rich woods, black cohosh will grow occasionally in sunny situations in fence corners and woodland pastures. It is most abundant in the Ohio Valley, but it occurs from Maine to Wisconsin, south along the Allegheny Mountains to Georgia, and westward to Missouri.

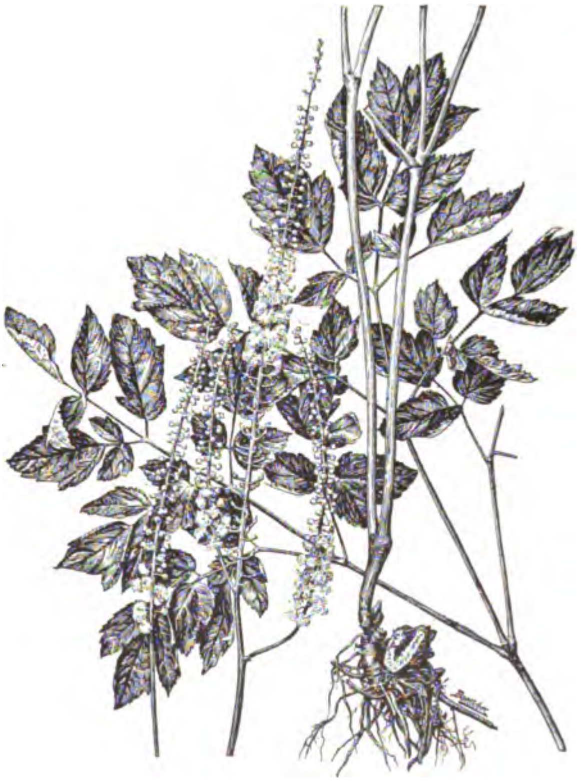

FIG. 12.—Black cohosh (*Cimicifuga racemosa*), leaves, flowering spikes, and rootstock.

Description of plant.—Rising to a height of 3 to 8 feet, the showy, delicate-flowered spikes of the black cohosh tower above most of the other woodland flowers, making it a conspicuous plant in the woods and one that can be easily recognized.

Black cohosh is an indigenous perennial plant belonging to the same family as the goldenseal, namely, the crowfoot family (Ranunculaceæ). The tall stem, sometimes 8 feet in height, is rather slender and leafy, the leaves consisting of three leaflets, which are again divided into threes. The leaflets are about 2 inches long, ovate, sharp pointed at the apex, thin and smooth, variously lobed, and the margins sharply toothed. The graceful, spikelike terminal cluster of flowers, which is produced from June to August, is from 6 inches to 2 feet in length. (Fig. 12.) Attractive as these flower clusters are to the eye, they generally do not prove attractive very long to those who may gather them for their beauty, since the flowers emit an offensive odor, which accounts for some of the common names applied to this plant, namely, bugbane and bugwort, it having been thought that this odor was efficacious in driving away bugs. The flowers do not all open at one time, and thus there may be seen buds, blossoms, and seed pods on one spike. The buds are white and globular, and as they expand in flower there is practically nothing to the flower but very numerous white stamens and the pistil, but the stamens spread out around the pistil in such a manner as to give to the spike a somewhat feathery or fluffy appearance which is very attractive. The seed pods are dry, thick and leathery, ribbed, and about one-fourth of an inch long, with a small beak at the end. The smooth brown seeds are inclosed within the pods in two rows. Anyone going through the woods in winter may find the seed pods, full of seeds, still clinging to the dry, dead stalk, and the rattling of the seeds in the pods as the wind passes over them has given rise to the common names rattle-snakeroot (not "rattlesnake"-root), rattleweed, rattletop, and rattleroot.

Description of rootstock.—The rootstock (fig. 12) is large, horizontal, and knotty or rough and irregular in appearance. The upper surface of the rootstock is covered with numerous round scars and stumps, the remains of former leaf stems, and on the fresh rootstocks may be seen the young, pinkish white buds which are to furnish the next season's growth. From the lower part of the rootstock long, fleshy roots are produced. The fresh rootstock is very dark reddish brown on the outside, white within, showing a large central pith from which radiate rays of a woody texture, and on breaking the larger roots also the woody rays will be seen in the form of a cross. On drying, the rootstock becomes hard and turns much darker, both internally and externally, but the peculiar cross formation of the woody rays in both rootstock and roots, being lighter in color, is plainly seen without the aid of a magnifying glass. The roots in drying become wiry and brittle and break off very readily. Black cohosh has a heavy odor and a bitter, acrid taste.

Collection, prices, and uses.—The root should be collected after the fruit has ripened, usually in September. The price ranges from 2 to 3 cents a pound.

The Indians had long regarded black cohosh as a valuable medicinal plant, not only for the treatment of snake bites, but it was also a very popular remedy among their women, and it is to-day considered of value as an alterative, emmenagogue, and sedative, and is recognized as official in the United States Pharmacopœia.

OREGON GRAPE.

Berberis aquifolium Pursh.

Pharmacopœial name.—Berberis.

Other common names.—Rocky Mountain grape, holly-leaved barberry, California barberry, trailing Mahonia.

Habitat and range.—This shrub is native in woods in rich soil among rocks from Colorado to the Pacific Ocean, but it is especially abundant in Oregon and northern California.

Description of plant.—Oregon grape is a low-growing shrub, resembling somewhat the familiar Christmas holly of the Eastern States, and, in fact, was first designated as "mountain-holly" by members of the Lewis and Clark expedition on their way through the western country. It belongs to the barberry family (Berberidaceæ), and grows about 2 to 6 feet in height, the branches sometimes trailing. The leaves consist of from 5 to 9 leaflets, borne in pairs, with an odd leaflet at the summit. They are from 2 to 3 inches long and about 1 inch wide, evergreen, thick, leathery, oblong or oblong ovate in outline, smooth and shining above, the margins provided with thorny spines or teeth. The numerous small yellow flowers appear in April or May and are borne in erect, clustered heads. The fruit consists of a cluster of blue or bluish purple berries, having a pleasant taste, and each containing from three to nine seeds. (Pl. IV, fig. 1.)

Other species.—While *Berberis aquifolium* is generally designated as the source of Oregon grape root, other species of Berberis are met with in the market under the name grape root, and their use is sanctioned by the United States Pharmacopœia.

The species most commonly collected with *Berberis aquifolium* is *B. nervosa* Pursh, which is also found in woods from California northward to Oregon and Washington. This is 9 to 16 inches in height, with a conspicuously jointed stem and 11 to 17 bright-green leaflets.

Another species of Berberis, *B. pinnata* Lag., attains a height of from a few inches to 5 feet, with from 5 to 9, but sometimes more, leaflets, which are shining above and paler beneath. This resembles *aquifolium* very closely and is often mistaken for it, but it is said that it has not been used by the medical profession, unless in local practice.[a] The root also is about the same size as that of *aquifolium*, while the root of *nervosa* is smaller.

Some works speak of *Berberis repens* Lindl. as another species often collected with *aquifolium*, but in the latest botanical manuals no such species is recognized, *B. repens* being given simply as a synonym for *B. aquifolium*.

Description of rootstock.—The rootstock and roots of Oregon grape are more or less knotty, in irregular pieces of varying lengths, and about an inch or less in diameter, with brownish bark and hard and tough yellow wood, showing a small pith and narrow rays. Oregon grape root has a very bitter taste and very slight odor.

Collection, prices, and uses.—Oregon grape root is collected in autumn and brings from 10 to 12 cents a pound. The bark should *not* be removed from the rootstocks, as the Pharmacopœia directs that such roots be rejected.

This root has long been used in domestic practice throughout the West as a tonic and blood purifier, and is now official in the United States Pharmacopœia. The berries are used in making preserves and cooling drinks.

BLUE COHOSH.

Caulophyllum thalictroides (L.) Michx.

Other common names.—Caulophyllum, pappoose-root, squawroot, blueberry-root, blue ginseng, yellow ginseng. (Pl. IV, fig. 2.)

Habitat and range.—Blue cohosh is found in the deep rich loam of shady woods from New Brunswick to South Carolina, westward to Nebraska, being abundant especially throughout the Allegheny Mountain region.

Description of plant.—This member of the barberry family (Berberidaceæ) is a perennial herb, 1 to 3 feet in height, and indigenous to this country. It bears at the top one large, almost stemless leaf, which is triternately compound—that is, the main leaf stem divides into three stems, which again divide into threes, and each division bears three leaflets. Sometimes there is a smaller leaf, but similar to the other, at the base of the flowering branch. The leaflets are thin in texture, oval, oblong, or obovate, and 3 to 5 lobed.

In the early stage of its growth this plant is covered with a sort of bluish green bloom, but it gradually loses this and becomes smooth. The flowers are borne in a small terminal panicle or head, and are small and greenish yellow. They appear from April to May, while the leaf is still small. The globular seeds, which ripen about August, are borne on stout stalks in membranous capsules and resemble dark-blue berries.

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[a] King's American Dispensatory, Vol. I, 1898, from Berberidaceæ, by C. G. and J. U. Lloyd, 1878.

Description of rootstock.—The thick crooked rootstock of blue cohosh is almost concealed by the mass of matted roots which surrounds it. There are numerous cup-shaped scars and small branches on the upper surface of the rootstock, while the lower surface gives off numerous long, crooked, matted roots. Some of the scars are depressed below the surface of the rootstock, while others are raised above it. The outside is brownish and the inside tough and woody. Blue cohosh possesses a slight odor and a sweetish, somewhat bitter and acrid taste. In the powdered state it causes sneezing.

Collection, prices, and uses.—The root is dug in the fall. Very often the roots of goldenseal or twinleaf are found mixed with those of blue cohosh. The price of blue cohosh root ranges from 2½ to 4 cents a pound.

Blue cohosh, official in the United States Pharmacopœia for 1890, is used as a demulcent, antispasmodic, emmenagogue, and diuretic.

TWINLEAF.

Jeffersonia diphylla (L.) Pers.

Other common names.—Jeffersonia, rheumatism-root, helmetpod, ground-squirrel pea, yellowroot.

Habitat and range.—Twinleaf inhabits rich shady woods from New York to Virginia and westward to Wisconsin.

Description of plant.—This native herbaceous perennial is only about 6 to 8 inches in height when in flower. At the fruiting stage it is frequently 18 inches in height. It is one of our early spring plants, and its white flower, resembling that of bloodroot, is produced as early as April.

The long-stemmed, smooth leaves, produced in pairs and arising from the base of the plant, are rather oddly formed. They are about 3 to 6 inches long, 2 to 4 inches wide, heart shaped or kidney shaped, but parted lengthwise into two lobes or divisions, really giving the appearance of two leaves; hence the common name "twinleaf." The flower with its eight oblong, spreading white petals measures about 1 inch across, and is borne at the summit of a slender stalk arising from the root. The many-seeded capsule is about 1 inch long, leathery, somewhat pear shaped, and opening halfway around near the top, the upper part forming a sort of lid. (Fig. 13.) Twinleaf belongs to the barberry family (Berberidaceæ).

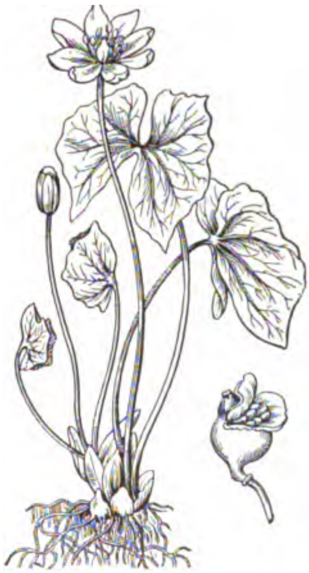

FIG. 13.—Twinleaf (*Jeffersonia diphylla*), plant and seed capsule. (After Britton and Brown, Illustrated Flora.)

Description of rootstock.—Twinleaf has a horizontal rootstock, with many fibrous, much-matted roots, and is very similar to that of blue cohosh, but not so long. It is thick, knotty, yellowish brown externally, with a resinous bark, and internally yellowish. The inner portion is nearly tasteless, but the bark has a bitter and acrid taste.

Collection, prices, and uses.—The rootstock is collected in autumn, and is used as a diuretic, alterative, antispasmodic, and a stimulating diaphoretic. Large doses are said to be emetic and smaller doses tonic and expectorant. The price paid for twinleaf root ranges from about 5 to 7 cents a pound.

MAY-APPLE.

Podophyllum peltatum L.

Pharmacopœial name.—Podophyllum.

Other common names.—Mandrake, wild mandrake, American mandrake, wild lemon, ground-lemon, hog-apple, devil's-apple, Indian apple, raccoon-berry, duck's-foot, umbrella-plant, vegetable calomel.

Habitat and range.—The May-apple is an indigenous plant, found in low woods, usually growing in patches, from western Quebec to Minnesota, south to Florida and Texas.

Description of plant.—A patch of May-apple can be distinguished from afar, the smooth, dark-green foliage and close and even stand making it a conspicuous feature of the woodland vegetation.

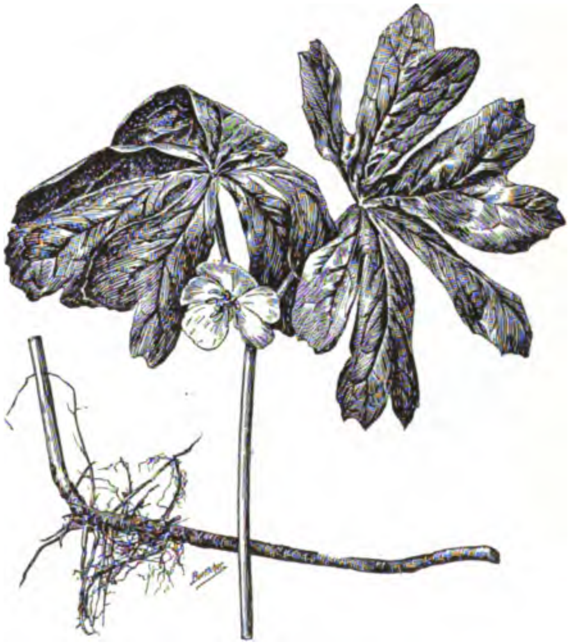

FIG. 14.—May-apple (*Podophyllum peltatum*), upper portion of plant with flower, and rootstock.

May-apple is a perennial plant, and belongs to the barberry family (Berberidaceæ). It is erect, and grows about 1 foot in height. The leaves are only two in number, circular in outline, but with five to seven deep lobes, the lobes 2 cleft, and toothed at the apex; they are dark green above, the lower surface lighter green and somewhat hairy or smooth, sometimes 1 foot in diameter, and borne on long leafstalks which are fixed to the center of the leaf, giving it an umbrella-like appearance. The waxy-white, solitary flower, sometimes 2 inches in diameter, appears in May, nodding on its short stout stalk, generally right between the two large umbrella-like leaves, which shade it and hide it from view. (Fig. 14.) The fruit which follows is lemon shaped, at first green, then yellow, about 2 inches in length, and edible, although when eaten immoderately it is known to have produced bad effects.

In a patch of May-apple plants there are always a number of sterile or flowerless stalks, which bear leaves similar to those of the flowering plants.

Description of rootstock.—The horizontally creeping rootstock of May-apple (fig. 14), when taken from the ground, is from 1 to 6 feet or more in length, flexible, smooth, and round, dark brown on the outside and whitish and fleshy within; at intervals of a few inches are thickened joints, on the upper surface of which are round stem scars and on the lower side a tuft of rather stout roots. Sometimes the rootstock bears lateral branches. The dried rootstock, as it occurs in the stores, is in irregular, somewhat cylindrical pieces, smooth or somewhat wrinkled, yellowish brown or dark brown externally, whitish to pale brown internally, breaking with a short, sharp fracture, the surface of which is mealy. The odor is slight and the taste at first sweetish, becoming very bitter and acrid.

Collection, prices, and uses.—The proper time for collecting the rootstock is in the latter half of September or in October. The price paid for May-apple root ranges from 3 to 6 cents a pound.

May-apple root, which is recognized as official in the United States Pharmacopœia, is an active cathartic, and was known as such to the Indians.

CANADA MOONSEED.

Menispermum canadense L.

Other common names.—Menispermum, yellow parilla, Texas sarsaparilla, yellow sarsaparilla, vine-maple. (Pl. IV, fig. 3.)

Habitat and range.—Canada moonseed is usually found along streams in woods, climbing over bushes, its range extending from Canada to Georgia and Arkansas.

Description of plant.—This native perennial woody climber reaches a length of from 6 to 12 feet, the round, rather slender stem bearing very broad, slender-stalked leaves. These leaves are from 4 to 8 inches wide, smooth and green on the upper surface and paler beneath, roundish in outline and entire, or sometimes lobed and resembling the leaves of some of our maples, whence the common name "vine-maple" is probably derived. The bases of the leaves are generally heart shaped and the apex pointed or blunt. In July the loose clusters of small yellowish or greenish white flowers are produced, followed in September by bunches of black one-seeded fruit, covered with a "bloom" and very much resembling grapes. Canada moonseed belongs to the moonseed family (Menispermaceæ).

Description of rootstock.—The rootstock and roots are employed in medicine. In the stores it will be found in long, straight pieces, sometimes 3 feet in length, only about one-fourth of an inch in thickness, yellowish brown or grayish brown, finely wrinkled lengthwise, and giving off fine, hairlike, branched, brownish roots from joints which occur every inch or so. The inside shows a distinct white pith of variable thickness and a yellowish white wood with broad, porous wood rays, the whole breaking with a tough, woody fracture. It has practically no odor, but a bitter taste.

Collection, prices, and uses.—Canada moonseed is collected in autumn, and brings from 4 to 8 cents a pound. It is used as a tonic, alterative, and diuretic, and was official in the United States Pharmacopœia for 1890.

BLOODROOT.

Sanguinaria canadensis L.

Pharmacopœial name.—Sanguinaria.

Other common names.—Redroot, red puccoon, red Indian-paint, puccoon-root, coonroot, white puccoon, pauson, snakebite, sweet-slumber, tetterwort, turmeric.

Habitat and range.—Bloodroot is found in rich, open woods from Canada south to Florida and west to Arkansas and Nebraska.

Description of plant.—This indigenous plant is among the earliest of our spring flowers, the waxy-white blossom, enfolded by the grayish green leaf, usually making its appearance early in April. The stem and root contain a blood-red juice. Bloodroot is a perennial, and belongs to the same family as the opium poppy, the Papaveraceæ. Each bud on the thick, horizontal rootstock produces but a single leaf and a flowering scape, reaching about 6 inches in height (fig. 15). The plant is smooth, and both stem and leaves, especially when young, present a grayish green appearance, being covered with a "bloom" such as is found on some fruits. The leaves are palmately 5 to 9 lobed, the lobes either cleft at the apex or having a wavy margin, and are borne on leaf stems about 6 to 14 inches long. After the plants have ceased flowering the leaves, at first only 3 inches long and 4 to 5 inches broad, continue to expand until they are about 4 to 7 inches long and 6 to 12 inches broad. The under side of the leaf is paler than the upper side and shows prominent veins. The flower measures about 1 inch across, is white, rather waxlike in appearance, with numerous golden-yellow stamens in the center. The petals soon fall off, and the oblong, narrow seed pod develops, attaining a length of about an inch.

Description of rootstock.—When dug out of the ground bloodroot is rather thick, round, and fleshy, slightly curved at the ends, and contains a quantity of blood-red juice. It is from 1 to 4 inches in length, from ½ to 1 inch in thickness, externally reddish brown, internally a bright-red blood color, and produces many thick, orange-colored rootlets. (Fig. 15.)

The rootstock shrinks considerably in drying, the outside turning dark brown and the inside orange-red or yellowish with numerous small red dots, and it breaks with a short, sharp fracture. It has but a slight odor, and the taste is bitter and acrid and very persistent. The powdered root causes sneezing.

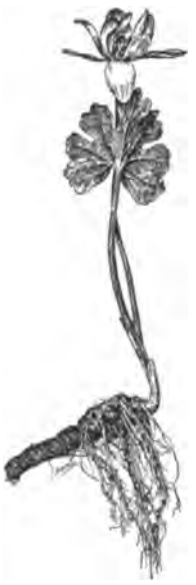

FIG. 15.—Bloodroot (*Sanguinaria canadensis*), flowering plant with rootstock.

Collection, prices, and uses.—The rootstock should be collected in autumn, after the leaves have died, and after curing it should be stored in a dry place, as it rapidly deteriorates if allowed to become moist. Age also impairs its activity. The price paid to collectors for this root ranges from about 5 to 10 cents a pound.

Bloodroot was well known to the American Indians, who used the red juice as a dye for skins and baskets and for painting their faces and bodies. It is official in the United States Pharmacopœia, and is used as a tonic, alterative, stimulant, and emetic.

HYDRANGEA.

Hydrangea arborescens L.

Other common names.—Wild hydrangea, seven-barks.

Habitat and range.—Hydrangea frequents rocky river banks and ravines from the southern part of New York to Florida, and westward to Iowa and Missouri, being especially abundant in the valley of the Delaware and southward.

Description of plant.—Hydrangea is an indigenous shrub, 5 to 6 feet or more in height, with weak twigs, slender leaf stems and thin leaves. It belongs to the hydrangea family (Hydrangeaceæ). The leaves are oval or sometimes heart shaped, 3 to 6 inches long, sharply toothed, green on both sides, the upper smooth and the lower sometimes hairy. The shrub is in flower from June to July, producing loose, branching, terminal heads of small, greenish white flowers, followed by membranous, usually 2-celled capsules, which contain numerous seeds. (Pl. IV, fig. 4.) Sometimes hydrangea will flower a second time, early in fall.

A peculiar characteristic of this shrub, and one that has given rise to the common name "seven-barks," is the peeling off of the stem bark, which comes off in several successive layers of thin, different colored bark.

Description of root.—The root is roughly branched and when first taken from the ground is very juicy, but after drying it becomes hard. The smooth white and tough wood is covered with a thin, pale-yellow or light-brown bark, which readily scales off. The wood is tasteless, but the bark has a pleasant aromatic taste, becoming somewhat pungent.

Collection, prices, and uses.—Hydrangea root is collected in autumn, and as it becomes very tough after drying and difficult to bruise it is best to cut the root in short transverse pieces while it is fresh and still juicy and dry it in this way. The price ranges from 2 to 7 cents a pound.

Hydrangea has diuretic properties and is said to have been much used by the Cherokees and early settlers in calculous complaints.

INDIAN-PHYSIC.

Porteranthus trifoliatus (L.) Britton.

Synonym.—*Gillenia trifoliata* Moench.

Other common names.—Gillenia, bowman's-root, false ipecac, western dropwort, Indian-hippo.

Habitat and range.—Indian-physic is native in rich woods from New York to Michigan, south to Georgia and Missouri.

Description of plant.—The reddish stems of this slender, graceful perennial of the rose family (Rosaceæ) are about 2 to 3 feet high, several erect and branched stems being produced from the same root. The leaves are almost stemless and trifoliate; that is, composed of three leaflets. They are ovate or lanceolate, 2 to 3 inches long, narrowed at the base, smooth, and toothed. The nodding, white or pinkish flowers are few, produced in loose terminal clusters from May to July. (Pl. V, fig. 1.) The five petals are long, narrowed or tapering toward the base, white or pinkish, and inserted in the tubular, somewhat bell-shaped, red-tinged calyx. The seed pods are slightly hairy.

At the base of the leaf stems are small leaflike parts, called stipules, which in this species are very small, linear, and entire. In the following species, which is very similar to *trifoliatus* and collected with it, the stipules, however, are so much larger that they form a prominent character, which has given rise to its specific name, *stipulatus*.

Porteranthus stipulatus (Muhl.) Britton (Syn. *Gillenia stipulacea* Nutt.) is found in similar situations as *P. trifoliatus*, but generally farther west, its range extending from western New York to Indiana and Kansas, south to Alabama, Louisiana, and Indian Territory. The general appearance of this plant is very similar to that of *P. trifoliatus*. It grows to about the same height, but is generally more hairy, the leaflets narrower and more deeply toothed, and the flowers perhaps a trifle smaller. The stipules, however, will generally serve to distinguish it. These are large, broad, ovate, acute at the apex, sharply and deeply notched, and so much like leaves that but for their position at the base of the leaf stems they might easily be mistaken for them.

With the exception of the name American ipecac applied to this plant, the common names of *Porteranthus trifoliatus* are also used for *P. stipulatus*. The roots of both species are collected and used for the same purposes.

Description of roots.—The root of *Porteranthus trifoliatus* is thick and knotty, with many smoothish, reddish brown rootlets (Pl. V, fig. 1), the latter in drying becoming wrinkled lengthwise and showing a few transverse fissures or breaks in the bark, and the interior white and woody. There is practically no odor, and the woody portion is tasteless, but the bark, which is readily separable, is bitter, increasing the flow of saliva.

Porteranthus stipulatus has a larger, more knotty root, with rootlets that are more wavy, constricted, or marked with numerous transverse rings, and the bark fissured or breaking from the white woody portion at frequent intervals.

Collection, prices, and uses.—The roots of both species are collected in autumn. The price ranges from 2 to 4 cents a pound.

Indian-physic or bowman's root, as these names imply, was a popular remedy with the Indians, who used it as an emetic. From them the white settlers learned of its properties, and it is still used for its emetic action. This drug was at one time official in the United States Pharmacopœia, from 1820 to 1880. Its action is said to resemble that of ipecac.

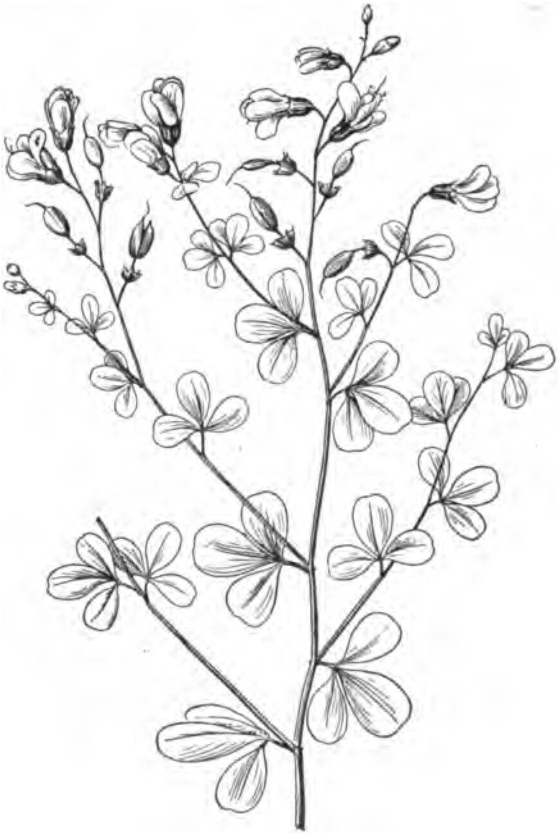

FIG. 16.—Wild indigo (*Baptisia tinctoria*), branch showing flowers and seed pods. (Modified from Barton's Vegetable Materia Medica.)

WILD INDIGO.

Baptisia tinctoria (L.) R. Br.

Other common names.—Baptisia, indigo-weed, yellow indigo, American indigo, yellow broom, indigo-broom, clover-broom, broom-clover, horsefly-weed, shoofly, rattlebush.

Habitat and range.—This native herb grows on dry, poor land, and is found from Maine to Minnesota, south to Florida and Louisiana.

Description of plant.—Many who have been brought up in the country will recognize in the wild indigo the plant so frequently used by farmers, especially in Virginia and Maryland, to keep flies away from horses, bunches of it being fastened to the harness for this purpose.

Wild indigo grows about 2 to 3 feet in height, and the cloverlike blossoms and leaves will show at once that it belongs to the same family as the common sometimes slightly tinged with red, from 6 inches to a foot in height, and generally unbranched. The leaves alternate on the stem, are lance shaped or oblong lance shaped, thin in texture, 1 to 2 inches long, and stemless. The flowering spikes are borne on the ends of the stems and consist of rather crowded, small, greenish white, insignificant flowers. The flowering period of Seneca snakeroot is from May to June. The spike blossoms gradually, and when the lowermost flowers have already fruited the upper part of the spike is still in flower. The seed capsules are small and contain two black, somewhat hairy seeds. (Fig. 18.) The short slender stalks supporting these seed capsules have a tendency to break off from the main axis before the seed is fully mature, leaving the spike in a rather ragged-looking condition, and the yield of seed, therefore, is not very large. Seneca snakeroot belongs to the milkwort family (Polygalaceæ).

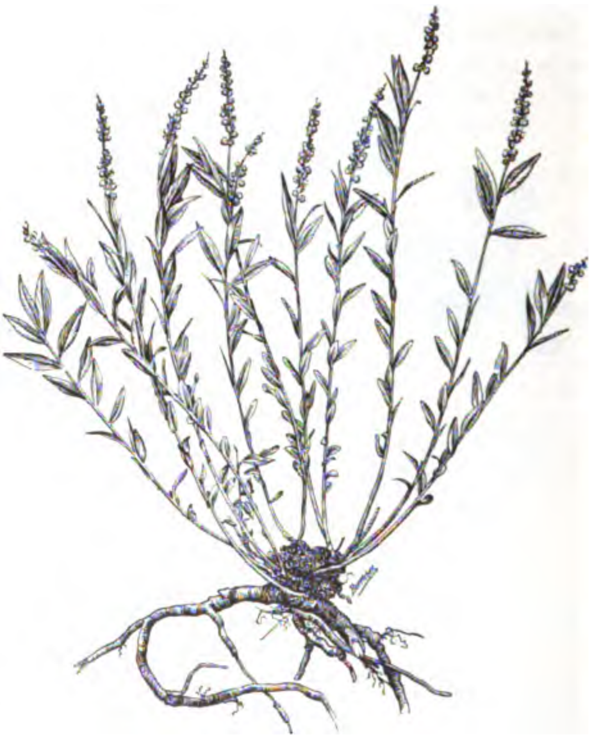

FIG. 18.—Seneca snakeroot (*Polygala senega*), flowering plant with root.

A form of Seneca snakeroot, growing mostly in the North-Central States and distinguished by its taller stems and broader leaves, has been called *Polygala senega* var. *latifolia*.

Description of root.—Seneca snakeroot (fig. 18) is described in the United States Pharmacopœia as follows: "Somewhat cylindrical, tapering, more or less flexuous, 3 to 15 cm. long and 2 to 8 mm. thick, bearing several similar horizontal branches and a few rootlets; crown knotty with numerous buds and short stem remnants; externally yellowish gray or brownish yellow, longitudinally wrinkled, usually marked by a keel which is more prominent in perfectly dry roots near the crown; fracture short, wood light yellow, usually excentrically developed; odor slight, nauseating; taste sweetish, afterwards acrid."

The Seneca snakeroots found in commerce vary greatly in size, that obtained from the South, which is really the official drug, being usually light colored and small. The principal supply of Seneca snakeroot now comes from Minnesota, Wisconsin, and farther northward, and this western Seneca snakeroot has a much larger, darker root, with a crown or head sometimes measuring 2 or 3 inches across and the upper part of the root very thick. It is also less twisted and not so distinctly keeled.

Seneca snakeroot is often much adulterated with the roots of other species of Polygala and of other plants.

Collection, prices, and uses.—The time for collecting Seneca snakeroot is in autumn. Labor conditions play a great part in the rise and fall of prices for this drug. It is said that very little Seneca snakeroot has been dug in the Northwest during 1906, due to the fact that the Indians and others who usually engage in this work were so much in demand as farm hands and railroad laborers, which paid them far better than the digging of Seneca snakeroot. Collectors receive from about 55 to 70 cents a pound for this root.

This drug, first brought into prominence as a cure for snake bite among the Indians, is now employed as an expectorant, emetic, and diuretic. It is official in the Pharmacopœia of the United States.

STILLINGIA.

Stillingia sylvatica L.

Pharmacopœial name.—Stillingia.

Other common names.—Queen's-delight, queen's-root, silverleaf, nettle-potato.

Habitat and range.—This plant is found in dry, sandy soil and in pine barrens from Maryland to Florida west to Kansas and Texas.

Description of plant.—Like most of the other members of the spurge family (Euphorbiaceæ) stillingia also contains a milky juice. This indigenous, herbaceous perennial is about 1 to 3 feet in height, bright green and somewhat fleshy, with crowded leaves of a somewhat leathery texture. The leaves are practically stemless and vary greatly in form, from lance shaped, oblong, to oval and elliptical, round toothed or saw toothed. The pale-yellow flowers, which appear from April to October, are borne in a dense terminal spike and consist of two kinds, male and female, the male flowers arranged in dense clusters around the upper part of the stalk and the female flowers occurring at the base of the spike. (Fig. 19.) The seeds are contained in a roundish 3-lobed capsule.

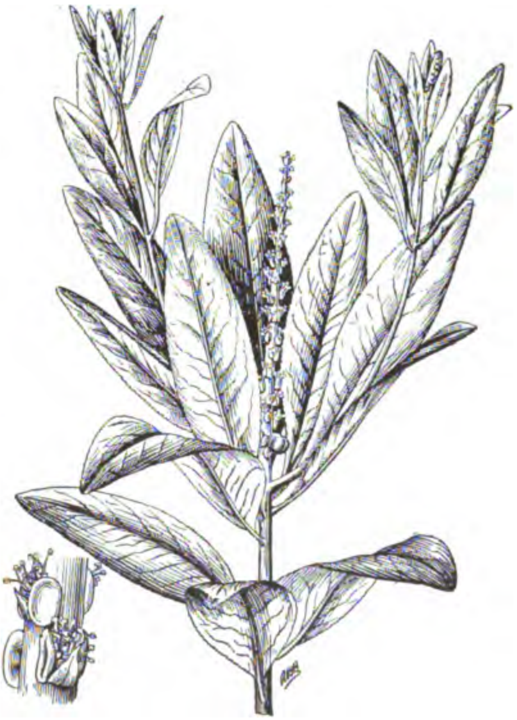

FIG. 19.—Stillingia (*Stillingia sylvatica*), upper portion of plant and part of spike showing male flowers. (After Bentley and Trimen, Medicinal Plants.)

Description of root.—Stillingia consists of somewhat cylindrical or slenderly spindle-shaped roots from 6 inches to a foot in length, slightly branched, the yellowish white, porous wood covered with a rather thick, reddish brown, wrinkled bark, the whole breaking with a fibrous fracture. As found in commerce, stillingia is usually in short transverse sections, the ends of the sections pinkish and fuzzy with numerous fine, silky bast fibers, and the bark showing scattered yellowish brown resin cells and milk ducts. It has a peculiar unpleasant odor, and a bitter, acrid, and pungent taste.

Collection, prices, and uses.—Stillingia root is collected late in autumn or early in spring, usually cut into short, transverse sections and dried. The price ranges from 3 to 5 cents a pound.

This root, which is official in the United States Pharmacopœia, has been a popular drug in the South for more than a century, and is employed principally as an alterative.

WILD SARSAPARILLA.

Aralia nudicaulis L.

Other common names.—False sarsaparilla, Virginian sarsaparilla, American sarsaparilla, small spikenard, rabbit's-root, shotbush, wild licorice.

Habitat and range.—Wild sarsaparilla grows in rich, moist woods from Newfoundland west to Manitoba and south to North Carolina and Missouri.

Description of plant.—This native herbaceous perennial, belonging to the ginseng family (Araliaceæ), produces a single, long-stalked leaf and flowering stalk from a very short stem, both surrounded or sheathed at the base by thin, dry scales. The leafstalk is about 12 inches long, divided at the top into three parts, each division bearing five oval, toothed leaflets from 2 to 5 inches long, the veins on the lower surface sometimes hairy.

The naked flowering stalk bears three spreading clusters of small, greenish flowers, each cluster consisting of from 12 to 30 flowers, produced from May to June, followed later in the season by purplish black roundish berries, about the size of the common elderberries. (Pl. V, fig. 2.)

Description of rootstock.—Wild sarsaparilla rootstock has a very fragrant, aromatic odor. Rabbits are said to be very fond of it, whence one of the common names, "rabbit's-root," is derived. The rootstock is rather long, horizontally creeping, somewhat twisted, and yellowish brown on the outside. (Pl. V, fig. 2.) The taste is warm and aromatic. The dried rootstock is brownish gray and wrinkled lengthwise on the outside, about one-fourth of an inch in thickness, the inside whitish with a spongy pith. The taste is sweetish and somewhat aromatic.

Collection, prices, and uses.—The root of wild sarsaparilla is collected in autumn, and brings from 5 to 8 cents a pound.

This has long been a popular remedy, both among the Indians and in domestic practice, and was official in the United States Pharmacopœia from 1820 to 1880. Its use is that of an alterative, stimulant, and diaphoretic, and in this it resembles the official sarsaparilla obtained from tropical America.

Similar species.—The American spikenard (*Aralia racemosa* L.), known also as spignet, spiceberry, Indian-root, petty-morrel, life-of-man, and old-man's-root, is employed like *Aralia nudicaulis*. It is distinguished from this by its taller, herbaceous habit, its much-branched stem from 3 to 6 feet high, and very large leaves consisting of thin, oval, heart-shaped, double saw-toothed leaflets. The small greenish flowers are arranged in numerous clusters, instead of only three as in *nudicaulis*, and also appear somewhat later, namely, from July to August. The berries are roundish, reddish brown, or dark purple.

The rootstock is shorter than that of *nudicaulis*, and much thicker, with prominent stem scars, and furnished with numerous, very long, rather thick roots. The odor and taste are stronger than in *nudicaulis*. It is also collected in autumn, and brings from 4 to 8 cents a pound.

The American spikenard occurs in similar situations as *nudicaulis*, but its range extends somewhat farther south, Georgia being given as the southern limit.

The California spikenard (*Aralia californica* Wats.) may be used for the same purposes as the other species. The plant is larger than *Aralia racemosa*, but otherwise is very much like it. The root is also larger than that of *A. racemosa*.

GINSENG.

Panax quinquefolium L.

Other common names.—American ginseng, sang, red-berry, five-fingers. (Pl. V, fig. 3.)

Habitat and range.—Ginseng is a native of this country, its favorite haunts being the rich, moist soil in hardwood forests from Maine to Minnesota southward to the mountains of northern Georgia and Arkansas. For some years ginseng has been cultivated in small areas from central New York to Missouri.

Description of plant.—Ginseng is an erect perennial plant growing from 8 to 15 inches in height, and bearing three leaves at the summit, each leaf consisting of five thin, stalked, ovate leaflets, long pointed at the apex, rounded or narrowed at the base, the margins toothed; the three upper leaflets are largest and the two lower ones smaller. From 6 to 20 greenish yellow flowers are produced in a cluster during July and August, followed later in the season by bright crimson berries. It belongs to the ginseng family (Araliaceæ).

Description of root.—Ginseng has a thick, spindle-shaped root, 2 to 3 inches long or more, and about one-half to 1 inch in thickness, often branched, the outside prominently marked with circles or wrinkles. (Pl. V, fig. 3.) The spindle-shaped root is simple at first, but after the second year it usually becomes forked or branched, and it is the branched root, especially if it resembles the human form, that finds particular favor in the eyes of the Chinese, who are the principal consumers of this root.

Ginseng root has a thick, pale yellowish white or brownish yellow bark, prominently marked with transverse wrinkles, the whole root fleshy and somewhat flexible. If properly dried, it is solid and firm. Ginseng has a slight aromatic odor, and the taste is sweetish and mucilaginous.

Collection and uses.—The proper time for digging ginseng root is in autumn, and it should be carefully washed, sorted, and dried. If collected at any other season of the year, it will shrink more and not have the fine plump appearance of the fall-dug root.

The National Dispensatory contains an interesting item concerning the collection of the root by the Indians. They gather the root only after the fruit has ripened, and it is said that they bend down the stem of ripened fruit before digging the root, covering the fruit with earth, and thus providing for future propagation. The Indians claim that a large percentage of the seeds treated in this way will germinate.

Although once official in the United States Pharmacopœia, from 1840 to 1880, it is but little used medicinally in this country except by the Chinese residents, most of the ginseng produced in this country being exported to China. The Chinese regard ginseng root as a panacea. It is on account of its commercial prominence that it is included in this paper.

Cultivation.—There is probably no plant that has become better known, at least by name, during the past ten years or more than ginseng. It has been heralded from north to south and east to west as a money-making crop. The prospective ginseng grower must not fail to bear in mind, however, that financial returns are by no means immediate. Special conditions and unusual care are required in ginseng cultivation, diseases must be contended with, and a long period of waiting is in store for him before he can realize on his crop.

Either roots or seeds may be planted, and the best success with ginseng is obtained by following as closely as possible the conditions of its native habitat. Ginseng needs a deep, rich soil, and, being a plant accustomed to the shade of forest trees, will require shade, which can be supplied by the erection of lath sheds over the beds. A heavy mulch of leaves or similar well-rotted vegetable material should be applied to the beds in autumn.

If roots are planted, they are set in rows about 8 inches apart and 8 inches apart in the row. In this way a marketable product will be obtained sooner than if grown from seed. The seed is sown in spring or autumn in drills 6 inches apart and about 2 inches apart in the row. The plants remain in the seed bed for two years and are then transplanted, being set about 8 by 8 inches apart. It requires from five to seven years to obtain a marketable crop from the seed. Seed intended for sowing should not be allowed to dry out, as this is supposed to destroy its vitality.

Price.—The price of wild ginseng roots ranges from $5 a pound upward. The cultivated root generally brings a lower price than the wild root, and southern ginseng roots are worth less than those from northern localities.

Exports.—The exports of ginseng for the year ended June 30, 1906, amounted to 160,949 pounds, valued at $1,175,844.

WATER-ERYNGO.

Eryngium yuccifolium Michx.

Synonym.—*Eryngium aquaticum* L.

Other common names.—Eryngium, eryngo, button-snakeroot, corn-snakeroot, rattlesnake-master, rattlesnake-weed, rattlesnake-flag.

Habitat and range.—Although sometimes occurring on dry land, water-eryngo usually inhabits swamps and low, wet ground, from the pine barrens of New Jersey westward to Minnesota and south to Texas and Florida.

Description of plant.—The leaves of this plant are grasslike in form, rigid, 1 to 2 feet long, and about one-half inch or a trifle more in width; they are linear, with parallel veins, pointed, generally clasping at the base, and the margins bristly with soft, slender spines. The stout, furrowed stem reaches a height of from 2 to 6 feet, and is generally unbranched except near the top. The insignificant whitish flowers are borne in dense, ovate-globular, stout-stemmed heads, appearing from June to September, and the seed heads that follow are ovate and scaly. (Pl. V, fig. 4.) Water-eryngo belongs to the parsley family (Apiaceæ) and is native in this country.

Description of rootstock.—The stout rootstock is very knotty, with numerous short branches, and produces many thick, rather straight roots (Pl. V, fig. 4), both rootstock and roots of a dark-brown color, the latter wrinkled lengthwise. The inside of the rootstock is yellowish white. Water-eryngo has a somewhat peculiar, slightly aromatic odor, and a sweetish, mucilaginous taste at first, followed by some bitterness and pungency.

Collection, prices, and uses.—The root of this plant is collected in autumn and brings from 5 to 10 cents a pound.

Water-eryngo is an old remedy, and one of its early uses, as the several common names indicate, was for the treatment of snake bites. It was official in the United States Pharmacopœia from 1820 to 1860, and is employed now as a diuretic and expectorant, and for promoting perspiration. In large doses it acts as an emetic, and the root, when chewed, excites a flow of saliva. It is said to resemble Seneca snakeroot in action.

AMERICAN ANGELICA.

Angelica atropurpurea L.

Synonym.—*Archangelica atropurpurea* Hoffm.

Other common names.—Angelica, purple-stemmed angelica, great angelica, high angelica, purple angelica, masterwort.

Habitat and range.—American angelica is a native herb, common in swamps and damp places from Labrador to Delaware and west to Minnesota.

Description of plant.—This strong-scented, tall, stout perennial reaches a height of from 4 to 6 feet, with a smooth, dark-purple, hollow stem 1 to 2 inches in diameter. The leaves are divided into three parts, each of which is again divided into threes; the rather thin segments are oval or ovate, somewhat acute, sharply toothed and sometimes deeply cut, and about 2 inches long. The lower leaves sometimes measure 2 feet in width, while the upper ones are smaller, but all have very broad expanded stalks. The greenish white flowers are produced from June to July in somewhat roundish, many-rayed umbels or heads, which sometimes are 8 to 10 inches in diameter. The fruits are smooth, compressed, and broadly oval. (Pl. VI, fig. 1.) American angelica belongs to the parsley family (Apiaceæ).

Description of root.—American angelica root is branched, from 3 to 6 inches long, and less than an inch in diameter. The outside is light brownish gray, with deep furrows, and the inside nearly white, the whole breaking with a short fracture and the thick bark showing fine resin dots. It has an aromatic odor, and the taste at first is sweetish and spicy, afterwards bitter. The fresh root is said to possess poisonous properties.

The root of the European or garden angelica (*Angelica officinalis* Moench) supplies much of the angelica root of commerce. This is native in northern Europe and is very widely cultivated, especially in Germany, for the root.

Collection, prices, and uses.—The root is dug in autumn and carefully dried. Care is also necessary in preserving the root, as it is very liable to the attacks of insects. American angelica root ranges from 6 to 10 cents a pound.

American angelica root, which was official in the United States Pharmacopœia from 1820 to 1860, is used as an aromatic, tonic, stimulant, carminative, diuretic, and diaphoretic. In large doses it acts as an emetic.

The seeds are also employed medicinally.

YELLOW JASMINE OR JESSAMINE.

Gelsemium sempervirens (L.) Ait. f.

Pharmacopœial name.—Gelsemium.

Other common names.—Carolina jasmine or jessamine, Carolina wild woodbine, evening trumpet-flower.

Habitat and range.—Yellow jasmine is a plant native to the South, found along banks of streams, in woods, lowlands, and thickets, generally near the coast, from the eastern part of Virginia to Florida and Texas, south to Mexico and Guatemala.

Description of plant.—This highly ornamental climbing or trailing plant is abundantly met with in the woods of the Southern States, its slender stems festooned over trees and fences and making its presence known by the delightful perfume exhaled by its flowers, filling the air with a fragrance that is almost overpowering wherever the yellow jasmine is very abundant.

The smooth, shining stems of this beautiful vine sometimes reach a length of 20 feet. The leaves are evergreen, lance shaped, entire, 1½ to 3 inches long, rather narrow, borne on short stems, and generally remaining on the vine during the winter. The flowers, which appear from January to April, are bright yellow, about 1 to 1½ inches long, the corolla funnel shaped. (Fig. 20.) They are very fragrant, but poisonous, and it is stated that the eating of honey derived from jasmine flowers has brought about fatal results.

Yellow jasmine is a perennial, and belongs to a family that is noted for its poisonous properties, namely, the Logania family (Loganiaceæ), which numbers among its members such powerful poisonous agents as the strychnine-producing tree.

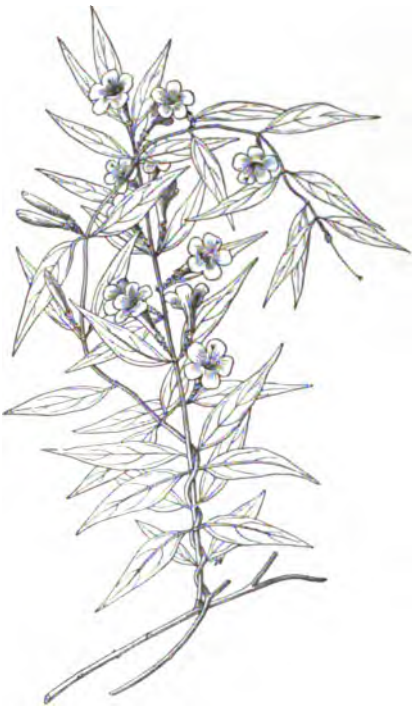

FIG. 20.—Yellow jasmine (*Gelsemium sempervirens*).

Description of rootstock.—The rootstock of the yellow jasmine is horizontal and runs near the surface of the ground, attaining great length, 15 feet or more; it is branched, and here and there produces fibrous rootlets. When freshly removed from the ground it is very yellow, with a peculiar odor and bitter taste. For the drug trade it is generally cut into pieces varying from 1 inch to 6 inches in length, and when dried consists of cylindrical sections about 1 inch in thickness, the roots, of course, thinner. The bark is thin, yellowish brown, with fine silky bast fibers, and the wood is tough and pale yellow, breaking with a splintery fracture and showing numerous fine rays radiating from a small central pith. Yellow jasmine has a bitter taste and a pronounced heavy odor.

Collection, prices, and uses.—The root of yellow jasmine is usually collected just after the plant has come into flower and is cut into pieces from 1 to 6 inches long. It is often adulterated with portions of the stems, but these can be distinguished by their thinness and dark purplish color. The prices range from 3 to 5 cents a pound.

Yellow jasmine, which is official in the United States Pharmacopœia, is used for its powerful effect on the nervous system.

PINKROOT.

Spigelia marilandica L.

Pharmacopœial name.—Spigelia.

Other common names.—Carolina pinkroot, Carolina pink, Maryland pink, Indian pink, starbloom, wormgrass, wormweed, American wormroot.

Habitat and range.—This pretty little plant is found in rich woods from New Jersey to Florida, west to Texas and Wisconsin, but occurring principally in the Southern States. It is fast disappearing, however, from its native haunts.

Description of plant.—Pinkroot belongs to the same family as the yellow jasmine, namely, the Logania family (Loganiaceæ), noted for its poisonous species. It is a native perennial herb, with simple, erect stem 6 inches to 1½ feet high, nearly smooth. The leaves are stemless, generally ovate, pointed at the apex and rounded or narrowed at the base; they are from 2 to 4 inches long, one-half to 2 inches wide, smooth on the upper surface, and only slightly hairy on the veins on the lower surface. The rather showy flowers are produced from May to July in a terminal one-sided spike; they are from 1 to 2 inches in length, somewhat tube shaped, narrowed below, slightly inflated toward the center, and again narrowed or contracted toward the top, and terminating in five lance-shaped lobes; the flowers are very showy, with their brilliant coloring—bright scarlet on the outside, and the inside of the tube and the lobes a bright yellow. The seed capsule is double, consisting of two globular portions more or less united, and containing numerous seeds. (Pl. VI, fig. 2.)

Description of rootstock.—The rootstock is rather small, from 1 to 2 inches in length and about one-sixteenth of an inch in thickness. It is somewhat crooked or bent, dark brown, with a roughened appearance of the upper surface caused by cup-shaped scars, the remains of former annual stems. The lower surface and the sides have numerous long, finely branched, lighter colored roots, which are rather brittle. Pinkroot has a pleasant, aromatic odor, and the taste is described as sweetish, bitter, and pungent.

Collection, prices, and uses.—Pinkroot is collected after the flowering period. It is said to be scarce, and was reported as becoming scarce as long ago as 1830. The price paid to collectors ranges from 25 to 40 cents a pound.

The roots of other plants, notably those of the East Tennessee pinkroot (*Ruellia ciliosa* Pursh), are often found mixed with the true pinkroot, and the *Ruellia ciliosa* is even substituted for it. This adulteration or substitution probably accounts for the inertness which has sometimes been attributed to the true pinkroot and which has caused it to fall into more or less disuse. It has long been known that the true pinkroot was adulterated, but this adulteration was supposed to be caused by the admixture of Carolina phlox (*Phlox carolina* L., now known as *Phlox ovata* L.), but this is said now to be no part of the substitution.[a]

The rootstock of *Ruellia ciliosa* is larger and not as dark as that of the Maryland pinkroot and has fewer and coarser roots, from which the bark readily separates, leaving the whitish wood exposed.

Pinkroot was long known by the Indians, and its properties were made known to physicians by them. It is official in the United States Pharmacopœia, and is used principally as an anthelmintic.

AMERICAN COLOMBO.

Frasera carolinensis Walt.

Synonym.—*Frasera walteri* Michx.

Other common names.—Frasera, meadowpride, pyramid-flower, pyramid-plant, Indian lettuce, yellow gentian, ground-centaury.

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[a] Bulletin 100, Part V, Bureau of Plant Industry, "The Drug Known as Pinkroot."

Habitat and range.—American colombo occurs in dry soil from the western part of New York to Wisconsin, south to Georgia and Kentucky.

Description of plant.—During the first and second year of the growth of this plant only the root leaves are produced. These are generally somewhat rounded at the summit, narrowed toward the base, and larger than the stem leaves, which develop in the third year. The leaves are deep green and produced mostly in whorls of four, the stem leaves being 3 to 6 inches in length and oblong or lance shaped. In the third year the stem is developed and the flowers are produced from June to August. The stem is stout, erect, cylindrical, and 3 to 8 feet in height. The flowers of American colombo are borne in large terminal, handsome pyramidal clusters sometimes 2 feet in length, and are greenish yellow or yellowish white, dotted with brown purple. They are slender stemmed, about 1 inch across, with a wheel-shaped, 4-parted corolla. The seeds are contained in a much compressed capsule. (Fig. 21.) American colombo is an indigenous perennial, and belongs to the gentian family (Gentianaceæ).

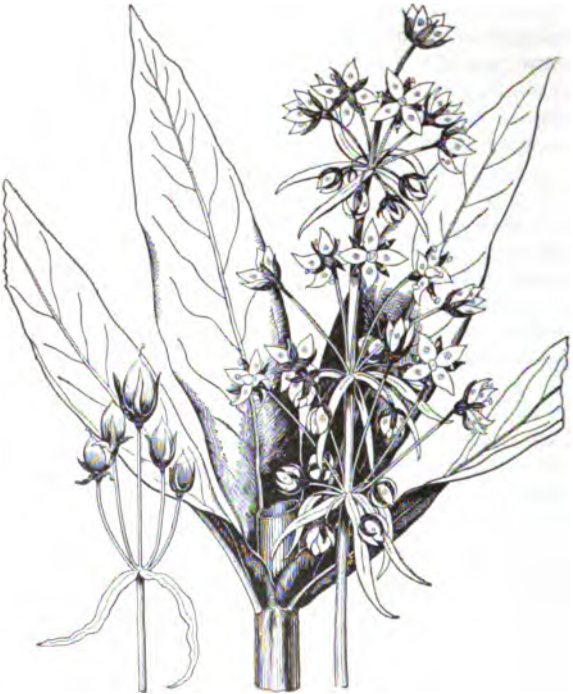

FIG. 21.—American colombo (*Frasera carolinensis*), leaves, flowers, and seed pods.

Description of root.—The root is long, horizontal, spindle shaped, yellow, and wrinkled. In the fresh state it is fleshy and quite heavy. The American colombo root of commerce, formerly in transverse slices, now generally occurs in lengthwise slices. The outside is yellowish or pale orange and the inside spongy and pale yellow. The taste is bitter. American colombo root resembles the official gentian root in taste and odor, and the uses are also similar.

Collection, prices, and uses.—The proper time for collecting American colombo root is in the autumn of the second year or in March or April of the third year. It is generally cut into lengthwise slices before drying. The price of American colombo root ranges from 3 to 5 cents a pound.

The dried root, which was official in the United States Pharmacopœia from 1820 to 1880, is used as a simple tonic. In the fresh state the root possesses emetic and cathartic properties.

BLACK INDIAN HEMP.

Apocynum cannabinum L.

Pharmacopœial name.—Apocynum.

Other common names.—Canadian hemp, American hemp, amy-root, bowman's-root, bitterroot, Indian-physic, rheumatism-weed, milkweed, wild cotton, Choctaw-root.

The name "Indian hemp" is often applied to this plant, but it should never be used without the adjective "black." "Indian hemp" is a name that properly belongs to *Cannabis indica*, a true hemp plant, from which the narcotic drug "hashish" is obtained.

Habitat and range.—Black Indian hemp is a native of this country, and may be found in thickets and along the borders of old fields throughout the United States.

Description of plant.—This is a common herbaceous perennial about 2 to 4 feet high, with erect or ascending branches, and, like most of the plants belonging to the dogbane family (Apocynaceæ), contains a milky juice. The short-stemmed opposite leaves are oblong, lance-shaped oblong or ovate-oblong, about 2 to 6 inches long, usually sharp pointed, the upper surface smooth and the lower sometimes hairy. The plant is in flower from June to August and the small greenish white flowers are borne in dense heads, followed later by the slender pods, which are about 4 inches in length and pointed at the apex. (Fig. 22.)

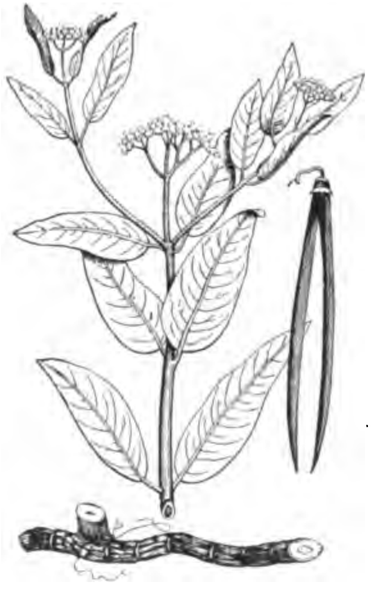

FIG. 22.—Black Indian hemp (*Apocynum cannabinum*), flowering portion, pods, and rootstock (After King's American Dispensatory.)

Other species. — Considerable confusion seems to exist in regard to which species yields the root which has proved of greatest value medicinally. The Pharmacopœia directs that "the dried rhizome and roots of *Apocynum cannabinum* or of closely allied species of Apocynum" be used.

In the older botanical works and medical herbals only two species of Apocynum were recognized, namely, *A cannabinum* L. and *A. androsaemifolium* L., although it was known that both of these were very variable. In the newer botanical manuals both of these species still hold good, but the different forms and variations are now recognized as distinct species, those formerly referred to *cannabinum* being distinguished by the erect or nearly erect lobes of the corolla, and those of the *androsaemifolium* group being distinguished by the spreading or recurved lobes of the corolla.

Among the plants that were formerly collected as *Apocynum cannabinum* or varietal forms of it, and which are now considered as distinct species, may be mentioned the following:

Riverbank-dogbane (*A. album* Greene), which frequents the banks of rivers and similar moist locations from Maine to Wisconsin, Virginia, and Missouri.

This plant is perfectly smooth and has white flowers and relatively smaller leaves than *A. cannabinum.*

Velvet dogbane (*A. pubescens* R. Br.), which is common from Virginia to Illinois, Iowa, and Missouri. The entire plant has a soft, hairy or velvety appearance, which renders identification easy. According to the latest edition of the National Standard Dispensatory it is not unlikely that this is the plant that furnishes the drug that has been so favorably reported upon.

Apocynum androsaemifolium is also gathered by drug collectors for *Apocynum cannabinum.* Its root is likewise employed in medicine, but its action is not the same as that of *cannabinum,* and it should therefore not be substituted for it. It closely resembles *cannabinum.*

Description of rootstock.—The following description of the drug as found in commerce is taken from the United States Pharmacopœia: "Of varying length, 3 to 8 mm. thick, cylindrical or with a few angles produced by drying, lightly wrinkled longitudinally, and usually more or less fissured transversely; orange-brown, becoming gray-brown on keeping; brittle; fracture sharply transverse, exhibiting a thin brown layer of cork, the remainder of the bark nearly as thick as the radius of the wood, white or sometimes pinkish, starchy, containing laticiferous ducts; the wood yellowish, having several rings, finely radiate and very coarsely porous; almost inodorous, the taste starchy, afterwards becoming bitter and somewhat acrid."

Collection, prices, and uses.—The root of black Indian hemp is collected in autumn and brings from 8 to 10 cents a pound.

It is official in the United States Pharmacopœia and has emetic, cathartic, diaphoretic, expectorant, and diuretic properties, and on account of the last-named action it is used in dropsical affections.

The tough fibrous bark of the stalks of black Indian hemp was employed by the Indians as a substitute for hemp in making twine, fishing nets, etc.

PLEURISY-ROOT.

Asclepias tuberosa L.

Pharmacopœial name.—Asclepias.

Other common names.—Butterfly-weed, Canada-root, Indian-posy, orange-root, orange swallowwort, tuberroot, whiteroot, windroot, yellow or orange milkweed.

Habitat and range.—Pleurisy-root flourishes in the open or in pine woods, in dry sandy or gravelly soil, usually along the banks of streams. Its range extends from Ontario and Maine to Minnesota, south to Florida, Texas, and Arizona, but it is found in greatest abundance in the South.

Description of plant.—This is a very showy and ornamental perennial plant, indigenous to this country, and belonging to the milkweed family (Asclepiadaceæ); it is erect and rather stiff in habit, but with brilliant heads of bright orange-colored flowers that attract attention from afar.

The stems are rather stout, erect, hairy, about 1 to 2 feet in height, sometimes branched near the top, and bearing a thick growth of leaves. These are either stemless or borne on short stems, are somewhat rough to the touch, 2 to 6 inches long, lance shaped or oblong, the apex either sharp pointed or blunt, with a narrow, rounded, or heart-shaped base. The flower heads, borne at the ends of the stem and branches, consist of numerous, oddly shaped orange-colored flowers. The corolla is composed of five segments, which are reflexed or turned back, and the crown has five erect or spreading "hoods," within each of which is a slender incurved horn. The plant is in flower for some time, usually from June to September, followed late in fall by pods, which are from 4 to 5 inches long, green, tinged with red, finely hairy on the outside, and containing the seeds with their long silky hairs. (Pl. VI, fig. 3.) Unlike the other milkweeds, the pleurisy-root contains little or no milky juice.

Description of root.—The root of this plant is large, white and fleshy, spindle shaped, branching. (Pl. VI, fig. 3.) As found in commerce it consists of lengthwise or crosswise pieces from 1 to 6 inches in length and about three-fourths of an inch in thickness. It is wrinkled lengthwise and also transversely and has a knotty head. The thin bark is orange brown and the wood yellowish, with white rays. It has no odor, and a somewhat bitter, acrid taste.

Collection, prices, and uses.—The root, which is usually found rather deep in the soil, is collected in autumn, cut into transverse or lengthwise slices, and dried. The price ranges from 6 to 10 cents a pound.

Pleurisy-root was much esteemed by the Indians, has long been used in domestic practice, and is official in the United States Pharmacopœia. It is used in disordered digestion and in affections of the lungs, in the last-named instance to promote expectoration, relieve pains in the chest, and induce easier breathing. It is also useful in producing perspiration.

Other species.—Besides the official pleurisy-root there are two other species of Asclepias which are employed to some extent for the same purposes, namely, the common milkweed and the swamp-milkweed.

The common milkweed (*Asclepias syriaca* L.) is a perennial, native in fields and waste places from Canada to North Carolina and Kansas. It has a stout, usually simple stem 3 to 5 feet in height and oblong or oval leaves, smooth on the upper surface and densely hairy beneath. The flowers, similar in form to those of *Asclepias tuberosa*, are pinkish purple and appear from June to August, followed by erect pods 3 to 5 inches long, wooly with matted hairs and covered with prickles and borne on recurved stems. The plant contains an abundance of milky juice.

The root of the common milkweed is from 1 to 6 feet long, cylindrical, and finely wrinkled. The short branches and scars left by former stems give the root a rough, knotty appearance. The bark is thick, grayish brown, and the inside white, the root breaking with a short, splintery fracture. Common milkweed root has a very bitter taste, but no odor.

It is collected in autumn and cut into transverse slices before drying. Common milkweed root ranges from 6 to 8 cents a pound.

Swamp-milkweed (*Asclepias incarnata* L.) is a native perennial herb found in swamps from Canada to Tennessee and Kansas. The slender stem, leafy to the top, is 1 to 2 feet in height, branched above, the leaves lance shaped or oblong lance shaped. The flowers, also similar to those of *tuberosa*, appear from July to September, and are flesh colored or rose colored. The pods are 2 to 3½ inches long, erect, and very sparingly hairy.

The root of the swamp-milkweed, which is also collected in autumn, is not quite an inch in length, hard and knotty, with several light-brown rootlets. The tough white wood, which has a thick central pith, is covered with a thin, yellowish brown bark. It is practically without odor, and the taste, sweetish at first, finally becomes bitter. This root brings about 3 cents a pound.

COMFREY.

Symphytum officinale L.

Other common names.—Symphytum, healing-herb, knitback, ass-ear, backwort, blackwort, bruisewort, gum-plant, slippery-root.

Habitat and range.—Comfrey is naturalized from Europe, and occurs in waste places from Newfoundland to Minnesota, south to Maryland.

Description of plant.—This coarse, rough, hairy perennial herb is from 2 to 3 feet high, erect and branched, with thick, rough leaves, the lower ones ovate lance shaped, 3 to 10 inches long, pointed at the apex, and narrowed at the base into margined stems. The uppermost leaves are lance shaped, smaller, and stemless. Comfrey is in flower from June to August, the purplish or dirty-white, tubular, bell-shaped flowers numerous and borne in dense terminal clusters. (Pl. VI, fig. 4.) The nutlets which follow are brown, shining, and somewhat wrinkled. Comfrey belongs to the borage family (Boraginaceæ).

Description of root.—Comfrey has a large, deep, spindle-shaped root, thick and fleshy at the top, white inside, and covered with a thin, blackish brown bark. (Pl. VI, fig. 4.) The dried root is hard, black, and very deeply and roughly wrinkled, breaking with a smooth, white, waxy fracture. As it occurs in commerce it is in pieces ranging from about an inch to several inches in length, only about one-fourth of an inch in thickness, and usually considerably bent. It has a very mucilaginous, somewhat sweetish and astringent taste, but no odor.

Collection, prices, and uses.—The root is dug in autumn, or sometimes in early spring. Comfrey root when first dug is very fleshy and juicy, but about four-fifths of its weight is lost in drying. The price ranges from 4 to 8 cents a pound.

The mucilaginous character of comfrey root renders it useful in coughs and diarrheal complaints. Its action is demulcent and slightly astringent.

The leaves are also used to some extent.

STONEROOT.

Collinsonia canadensis L.

Other common names.—Collinsonia, knobroot, knobgrass, knobweed, knotroot, horse-balm, horseweed, richweed, richleaf, ox-balm, citronella.

Habitat and range.—Stoneroot is found in moist, shady woods from Maine to Wisconsin, south to Florida and Kansas.

Description of plant.—Like most of the other members of the mint family (Menthaceæ), stoneroot is aromatic also, the fresh flowering plant possessing a very pleasant, lemon-like odor. It is a tall, perennial herb, growing as high as 5 feet. The stem is stout, erect, branched, smooth, or the upper part hairy.

The leaves are opposite, about 3 to 8 inches long, thin, ovate, pointed at the apex, narrowed or sometimes heart shaped at the base, and coarsely toothed; the lower leaves are largest and are borne on slender stems, while the upper ones are smaller and almost stemless. Stoneroot is in flower from July to October, producing large, loose, open terminal panicles or heads of small, pale-yellow lemon-scented flowers. The flowers have a funnel-shaped 2-lipped corolla, the lower lip larger, pendent, and fringed, with two very much protruding stamens. (Pl. VII, fig. 1.)

Description of root.—Even the fresh root of this plant is very hard. It is
horizontal, large, thick, and woody, and the upper si [illegible] d knotty and
branched irregularly. (Pl. VII, fig. 1.) The od [illegible] rat
agreeable, and the taste pungent and spicy. In th
dry, the root is extremely hard, whence the com
dried root is grayish brown externally, irregularly
from the remains of branches and the scars left by
surface showing a few thin roots. T [illegible] the

Collection, prices, and uses.—Stoneroot, which is collected in autumn, is employed for its tonic, astringent, diuretic, and diaphoretic effects. The price of the root ranges from 2 to 3½ cents a pound.

The leaves are used by country people as an application to bruises.

CULVER'S-ROOT.

Veronica virginica L.[a]

Synonym.—*Leptandra virginica* (L.) Nutt.[a]

Pharmacopœial name.—Leptandra.

Other common names.—Culver's-physic, blackroot, bowman's-root, Beaumont-root, Brinton-root, tall speedwell, tall veronica, physic-root, whorlywort.

Habitat and range.—This common indigenous herb is found abundantly in moist, rich woods, mountain valleys, meadows, and thickets from British Columbia south to Alabama, Missouri, and Nebraska.

Description of plant.—Culver's-root is a tall, slender-stemmed perennial belonging to the figwort family (Scrophulariaceæ). It is from 3 to 7 feet in height, with the leaves arranged around the simple stems in whorls of three to nine. The leaves are borne on very short stems, are lance shaped, long pointed at the apex, narrowed at the base, and sharply toothed, 3 to 6 inches in length, and 1 inch or less in width. The white tube-shaped flowers, with two long protruding stamens, are produced from June to September and are borne in several ter[illegible]al densely crowded, slender, spikelike heads from 3 to 9 inches long. (Fig. 23.)

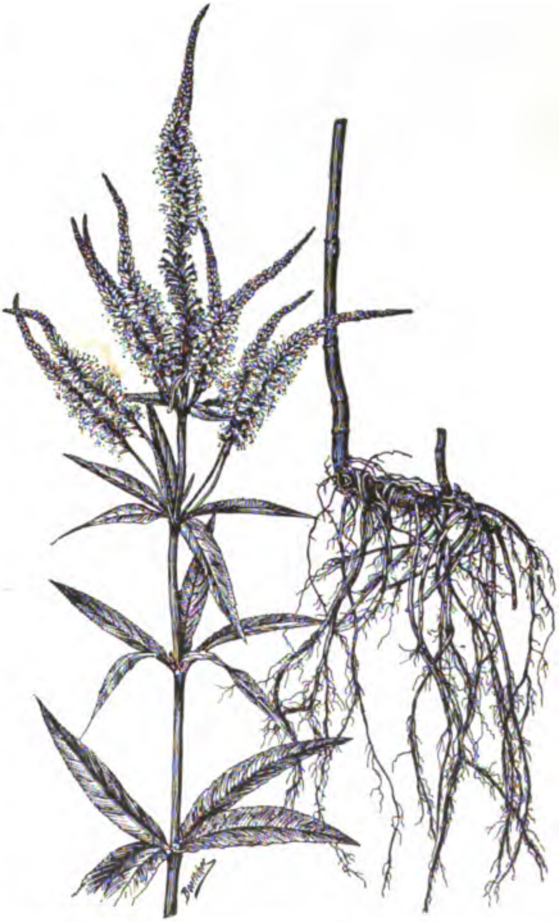

FIG. 23.—Culver's-root (*Veronica virginica*), flowering top and rootstock.

[illegible]thors hol[illegible]his plant belongs to the genus Leptandra and that [illegible]d be *[illegible]ginica* (L.) Nutt. The Pharmacopœia is here

The flowers, as stated, are usually white, though the color may vary from a pink to bluish or purple, and on account of its graceful spikes of pretty flowers it is often cultivated in gardens as an ornamental plant. The fruits are small, oblong, compressed, many-seeded capsules.

Description of rootstock.—After they are dried the rootstocks have a grayish brown appearance on the outside, and the inside is hard and yellowish, either with a hollow center or a brownish or purplish pith. When broken the fracture is tough and woody. The rootstock measures from 4 to 6 inches in length, is rather thick and bent, with branches resembling the main rootstock. The upper surface has a few stem scars, and from the sides and underneath numerous coarse, brittle roots are produced, which have the appearance of having been artificially inserted into the rootstock. (Fig. 23.) Culver's-root has a bitter and acrid taste, but no odor.

Collection, prices, and uses.—The rootstock and roots should be collected in the fall of the second year. When fresh these have a faint odor, resembling somewhat that of almonds, which is lost in drying. The bitter, acrid taste of Culver's-root also becomes less the longer it is kept, and it is said that it should be kept at least a year before being used. The price paid to collectors ranges from 6 to 10 cents a pound.

Culver's-root, which is official in the United States Pharmacopœia, is used as an alterative, cathartic, and in disorders of the liver.

DANDELION.

Taraxacum officinale Weber.[a]

Synonyms.—*Taraxacum taraxacum* (L.) Karst.;[a] *Taraxacum dens-leonis* Desf.

Pharmacopœial name.—Taraxacum.

Other common names.—Blow-ball, cankerwort, doon-head-clock, fortune-teller, horse gowan, Irish daisy, yellow gowan, one-o'clock. (Fig. 24.)

Habitat and range.—With the exception, possibly, of a few localities in the South, the dandelion is at home almost everywhere in the United States, being a familiar weed in meadows and waste places, and especially in lawns. It has been naturalized in this country from Europe and is distributed as a weed in all civilized parts of the world.

Description of plant.—It is hardly necessary to give a description of the dandelion, as almost everyone is familiar with the coarsely toothed, smooth, shining green leaves, the golden-yellow flowers which open in the morning and only in fair weather, and the round, fluffy seed heads of this only too plentiful weed of the lawns. In spring the young, tender leaves are much sought after by the colored market women about Washington, who collect them by the basketful and sell them for greens or salad.

Dandelion is a perennial belonging to the chicory family (Cichoriaceæ), and is in flower practically throughout the year. The entire plant contains a white milky juice.

Description of root.—The dandelion has a large, thick, and fleshy taproot, sometimes measuring 20 inches in length. In commerce, dandelion root is usually found in pieces 3 to 6 inches long, dark brown on the outside and strongly wrinkled lengthwise. It breaks with a short fracture and shows the thick whitish bark marked with circles of milk ducts and a thin woody center, which is yellow and porous. It is practically without odor and has a bitter taste.

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[a] Although the combination *Taraxacum taraxacum* (L.) Karst. should be accepted by right of priority, the usage of the Pharmacopœia is followed.

Collection and uses.—Late in summer and in fall the milky juice becomes thicker and the bitterness increases, and this is the time to collect dandelion root. It should be carefully washed and thoroughly dried. Dandelion roots lose considerably in drying, weighing less than half as much as the fresh roots. The dried root should not be kept too long, as drying diminishes its medicinal activity. It is official in the United States Pharmacopœia.

Dandelion is used as a tonic in diseases of the liver and in dyspepsia.

Imports and prices.—Most of the dandelion root found on the market is collected in central Europe. There has been an unusually large demand for dandelion root during the season of 1907, and according to the weekly records contained in the "Oil, Paint, and Drug Reporter," the imports entered at the port of New York from January 1, 1907, to the end of May amounted to about 47,000 pounds. The price ranges from 4 to 10 cents a pound.

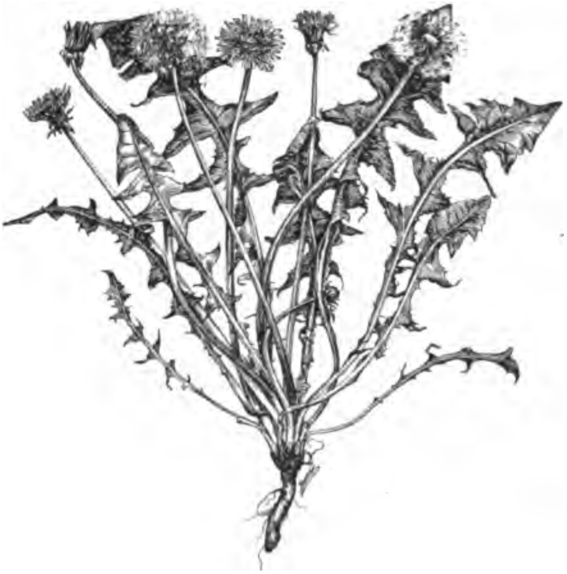

FIG. 24.—Dandelion (*Taraxacum officinale*).

QUEEN-OF-THE-MEADOW.

Eupatorium purpureum L.

Other common names.—Gravelroot, Indian gravelroot, joe-pye-weed, purple boneset, tall boneset, kidneyroot, king-of-the-meadow, marsh-milkweed, motherwort, niggerweed, quillwort, slunkweed, trumpetweed.

Habitat and range.—This common native perennial herb occurs in low grounds and dry woods and meadows from Canada to Florida and Texas.

Description of plant.—The stout, erect, green or purple stem of this plant grows from 3 to 10 feet in height, and is usually smooth, simple or branched at the top. The thin, veiny leaves are 4 to 12 inches long, 1 to 3 inches wide, ovate or ovate lance shaped, sharp pointed, toothed, and placed around the stem in whorls of three to six. While the upper surface of the leaves is smooth, there is usually a slight hairiness along the veins on the lower surface, otherwise smooth. Toward the latter part of the summer and in early fall queen-of-the-meadow is in flower, producing 5 to 15 flowered pink or purplish heads, all aggregated in large compound clusters, which present a rather showy appearance. (Pl. VII, fig. 2.) This plant belongs to the aster family (Asteraceæ).

Another species which is collected with this and for similar purposes, and by some regarded as only a variety, is the spotted boneset or spotted joe-pye-weed (*Eupatorium maculatum* L.). This is very similar to *E. purpureum*, but it does not grow so tall, is rough-hairy, and has the stem spotted with purple. The thicker leaves are coarsely toothed and in whorls of three to five, and the flower clusters are flattened at the top rather than elongated as in *E. purpureum*. It is found in moist soil from New York to Kentucky, westward to Kansas, New Mexico, Minnesota, and as far up as British Columbia.

Description of root.—Queen-of-the-meadow root, as it occurs in commerce, is blackish and woody, furnished with numerous long dark-brown fibers, which are furrowed or wrinkled lengthwise and whitish within. It has a bitter, aromatic, and astringent taste.

Collection, prices, and uses.—The root is collected in autumn and is used for its astringent and diuretic properties. It was official in the United States Pharmacopœia from 1820 to 1840. The price ranges from 2½ to 4 cents a pound.

ELECAMPANE.

Inula helenium L.

Other common names.—Inula, inul, horseheal, elf-dock, elfwort, horse-elder, scabwort, yellow starwort, velvet dock, wild sunflower.

Habitat and range.—This perennial herb has been naturalized from Europe, and is found along roadsides and in fields and damp pastures from Nova Scotia to North Carolina, westward to Missouri and Minnesota. It is native also in Asia.

Description of plant.—When in flower elecampane resembles the sunflower on a small scale. Like the sunflower, it is a member of the aster family (Asteraceæ). It is a rough plant, growing from 3 to 6 feet in height, but producing during the first year only root leaves, which attain considerable size. In the following season the stout densely hairy stem develops, attaining a height of from 3 to 6 feet.

The leaves are broadly oblong in form, toothed, the upper surface rough and the under side densely soft-hairy. The basal or root leaves are borne on long stems, and are from 10 to 20 inches long and 4 to 8 inches wide, while the upper leaves are smaller and stemless or clasping.

About July to September the terminal flower heads are produced, either singly or a few together. As already stated, these flower heads look very much like small sunflowers, 2 to 4 inches broad, and consist of long, narrow, yellow rays, 3 toothed at the apex, and the disk also is yellow. (Pl. VII, fig. 3.)

Description of root.—Elecampane has a large, long, branching root, pale yellow on the outside and whitish and fleshy within. (Pl. VII, fig. 3.) When dry the outside turns a grayish brown or dark brown, and is generally finely wrinkled lengthwise. As found in commerce, elecampane is usually in transverse or lengthwise slices, light yellow or grayish and fleshy internally, dotted with numerous shining resin cells, and with overlapping brown and wrinkled bark. These slices become flexible in damp weather, and tough, but when they are dry they break with a short fracture. The root has at first a strongly aromatic odor, which has been described by some as resembling a violet odor, but this diminishes in drying. The taste is aromatic, bitterish, and pungent.

Collection, prices, and uses.—The best time for collecting elecampane is in the fall of the second year. If collected later than that the roots are apt to be stringy and woody. Owing to the interlacing habit of the rootlets, much dirt adheres to the root, but it should be well cleaned, cut into transverse or lengthwise slices, and carefully dried in the shade. Collectors receive from 3 to 5 cents a pound for this root.

Elecampane, which was official in the United States Pharmacopœia of 1890, is much used in affections of the respiratory organs, in digestive and liver disorders, catarrhal discharges, and in skin diseases.

ECHINACEA.

Brauneria angustifolia (DC.) Heller.

Synonym.—*Echinacea angustifolia* DC.

Other common names.—Pale-purple coneflower, Sampson-root, niggerhead (in Kansas).

Habitat and range.—Echinacea is found in scattered patches in rich prairie soil or sandy soil from Alabama to Texas and northwestward, being most abundant in Kansas and Nebraska. Though not growing wild in the Eastern States, it has succeeded well under cultivation in the testing gardens of the Department of Agriculture at Washington, D. C.

Description of plant.—This native herbaceous perennial, belonging to the aster family (Asteraceæ), grows to a height of from 2 to 3 feet. It sends up a rather stout bristly-hairy stem, bearing thick rough-hairy leaves, which are broadly lance shaped or linear lance shaped, entire, 3 to 8 inches long, narrowed at each end, and strongly three nerved. The lower leaves have slender stems, but as they approach the top of the plant the stems become shorter and some of the upper leaves are stemless.

The flower heads, appearing from July to October, are very pretty, and the plant would do well as an ornamental in gardens. The flowers remain on the plant for a long time, and the color varies from whitish rose to pale purple. The heads consist of ray flowers and disk flowers, the former constituting the "petals" surrounding the disk, and the disk itself being composed of small, tubular, greenish yellow flowers. When the flowers first appear the disk is flattened or really concave, but as the flowering progresses it becomes conical in shape. The brown fruiting heads are conical, chaffy, stiff, and wiry. (Pl. VII, fig. 4.)

Description of root.—Echinacea has a thick, blackish root (Pl. VII, fig. 4), which in commerce occurs in cylindrical pieces of varying length and thickness. The dried root is grayish brown on the outside, the bark wrinkled lengthwise and sometimes spirally twisted. It breaks with a short, weak fracture, showing yellow or greenish yellow wood wedges, which give the impression that the wood is decayed.

The odor is scarcely perceptible, and the taste is mildly aromatic, afterwards becoming acrid and inducing a flow of saliva.

Collection, prices, and uses.—The root of echinacea is collected in autumn and brings from 20 to 30 cents a pound. It is said that echinacea varies greatly in quality, due chiefly to the locality in which it grows. According to J. U. Lloyd, the best quality comes from the prairie lands of Nebraska, and that from marshy places is inferior.

Echinacea is said to be an alterative, and to promote perspiration and induce a flow of saliva. The Indians used the freshly scraped roots for the cure of snake bites.

BURDOCK.

Arctium lappa L.

Synonym.—*Lappa major* Gaertn.

Pharmacopœial name.—Lappa.

Other common names.—Cockle-button, cuckold-dock, beggar's-buttons, hurr-bur, stick-button; hardock, bardane. (Fig. 25.)

Habitat and range.—Burdock, one of our most common weeds, was introduced from the Old World. It grows along roadsides, in fields, pastures, and waste places, being very abundant in the Eastern and Central States and in some scattered localities in the West.

Description of plant.—Farmers are only too well acquainted with this coarse, unsightly weed. During the first year of its growth this plant, which is a biennial belonging to the aster family (Asteraceæ), produces only a rosette of large, thin leaves from a long tapering root. In the second year a round, fleshy, and branched stem is produced, the plant when full grown measuring from 3 to 7 feet in height. This stem is branched, grooved, and hairy, bearing very large leaves, the lower ones often measuring 18 inches in length. The leaves are placed alternately on the stem, on long, solid, deeply furrowed leafstalks; they are thin in texture, smooth on the upper surface, pale and woolly underneath; usually heart shaped, but sometimes roundish or oval, with even, wavy, or toothed margins.

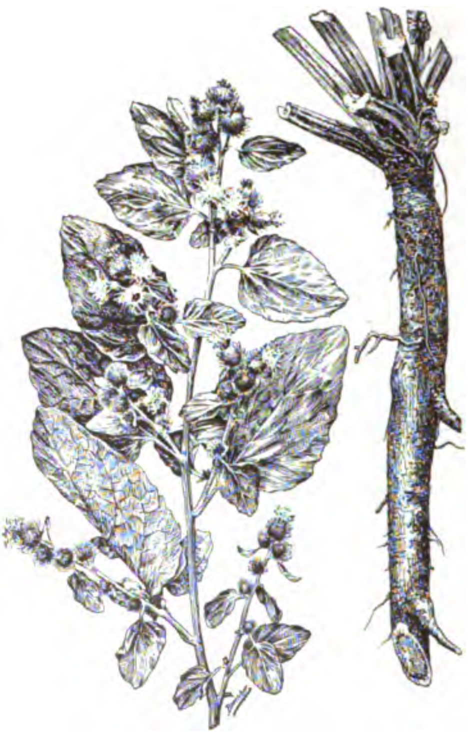

FIG. 25.—Burdock (*Arctium lappa*), flowering branch and root.

The flowers are not produced until the second year, appearing from July until frost. Burdock flowers are purple, in small, clustered heads armed with hooked tips, and the spiny burs thus formed are a great pest, attaching themselves to clothing and to the wool and hair of animals. Burdock is a very prolific seed producer, one plant bearing as many as 400,000 seeds.

Description of root.—Burdock has a large, fleshy taproot (fig. 25), which, when dry, becomes scaly and wrinkled lengthwise and has a blackish brown or grayish brown color on the outside, hard, breaking with a short, somewhat fleshy fracture, and showing the yellowish wood with a whitish spongy center. Sometimes there is a small, white, silky tuft at the top of the root, which is formed by the remains of the bases of the leafstalks. The odor of the root is weak and unpleasant, the taste mucilaginous, sweetish, and somewhat bitter.

While the root is met with in commerce in its entire state, it is more frequently in broken pieces or in lengthwise slices, the edges of which are turned inward. The roots of other species of Arctium are also employed.

Collection, prices, and uses.—Burdock root is official, and the United States Pharmacopœia directs that it be collected from plants of the first year's growth, either of *Arctium lappa* or of other species of Arctium. As burdock has a rather large, fleshy root, it is difficult to dry and is apt to become moldy, and for this reason it is better to slice the root lengthwise, which will facilitate the drying process. The price ranges from 5 to 10 cents a pound. The best root is said to come from Belgium, where great care is exercised in its collection and curing.

Burdock root is used as an alterative in blood and skin diseases. The seeds and fresh leaves are also used medicinally to a limited extent.

PLATES.

107 67

EXPLANATION OF PLATES.

Plate I. Fig. 1.—Marginal-fruited shield-fern (*Dryopteris marginalis*), showing upper surface of leaf, the lower surface with the "sori," or "fruit dots," arranged on the margins, and the erect, chaffy rootstock. Fig. 2.—Skunk-cabbage (*Spathyema foetida*), showing flowering plant with thick rootstock and whorl of crowded roots; unfolded leaf and spathe laid open to show rounded spadix; also seedling, and transverse section of rootstock. Fig. 3.—Sweet-flag (*Acorus calamus*), showing swordlike leaves, flowering head produced from the side of the stalk, and long, creeping rootstock. Fig. 4.—Bethroot (*Trillium erectum*), showing leaves, various views of the flower, and root. Arrangement of the different parts of the plant is in threes.

Plate II. Fig. 1.—Chamaelirium (*Chamaelirium luteum*), showing the male plant. Note the arrangement of the long-stemmed leaves along the entire stem and the graceful spike of feathery flowers, as compared with the grasslike basal leaves and the erect flowering spikes of Aletris (fig. 2), with which it is often confused. The rootstock of Chamaelirium, with the slightly curved upward end, is also shown. Fig. 2.—Aletris (*Aletris farinosa*). Note the grasslike leaves at the base of the stem and the erect spikes of urn-shaped flowers, as compared with the arrangement of the leaves all along the stem and the drooping plumelike spikes of Chamaelirium (fig. 1), with which Aletris is frequently confused. The rootstock of Aletris, which is rough and scaly and almost completely hidden by the fibrous roots, is, unfortunately, not well shown in the illustration. Fig. 3.—Wild yam (*Dioscorea villosa*), showing part of the vine, with its drooping clusters of flowers and 3-winged seed capsules; also the long, horizontal rootstock. Fig. 4.—Blue flag (*Iris versicolor*), showing sword-shaped leaves, the flowers, and part of the rootstock.

Plate III. Fig. 1.—Large yellow lady's-slipper (*Cypripedium hirsutum*), showing plant with its broad, parallel-veined leaves, and curious, baglike flower, and also rootstock with wavy roots. Fig. 2.—Canada snakeroot (*Asarum canadense*), showing, to the right, the flowering plant, and to the left the fruiting plant, together with the creeping rootstocks. Fig. 3.—Virginia serpentaria (*Aristolochia serpentaria*), plant showing seed capsules and rootstock. Fig. 4.—Soapwort (*Saponaria officinalis*), showing the upper flowering portion and seed pods; also the runners and roots.

Plate IV. Fig. 1.—Oregon grape (*Berberis aquifolium*), showing a branch with the leathery, holly-like leaves, and clusters of berries. Fig. 2.—Blue cohosh (*Caulophyllum thalictroides*), showing upper portion of the plant, with flowering head. Fig. 3.—Canada moonseed (*Menispermum canadense*), showing a portion of the vine in flower. Fig. 4.—Hydrangea (*Hydrangea arborescens*), showing a flowering and fruiting branch.

Plate V. Fig. 1.—Indian-physic (*Porteranthus trifoliatus*), showing upper flowering portion, and base of stem with root. Fig. 2.—Wild sarsaparilla (*Aralia nudicaulis*), showing flowering plant with rootstock, and to the left a fruiting head. Fig. 3.—Ginseng (*Panax quinquefolium*), showing the upper portion in flower, and the root. Fig. 4.—Water-eryngo (*Eryngium yuccifolium*), showing the long, grasslike leaves, stout-stemmed flowering heads, and rootstock.

Plate VI. Fig. 1.—American angelica (*Angelica atropurpurea*), showing leaves, fruiting head, and to the right a portion of the stem with broad, expanded leafstalk. Fig. 2.—Pinkroot (*Spigelia marilandica*), showing flowering top and seed capsules. Fig. 3.—Pleurisy-root (*Asclepias tuberosa*), showing flowering top, pods with escaping hairy seeds, and root. Fig. 4.—Comfrey (*Symphytum officinale*), showing the thick, rough leaves, the clusters of flowers, lower portion of plant with root, and sections of root.

Plate VII. Fig. 1.—Stoneroot (*Collinsonia canadensis*), showing flowering top and base of stem with root. Fig. 2.—Queen-of-the-meadow (*Eupatorium purpureum*), showing leaves and flowers. Fig. 3.—Elecampane (*Inula helenium*), showing leaves, flowers, and root. Fig. 4.—Echinacea (*Brauneria angustifolia*), showing flowering plant.

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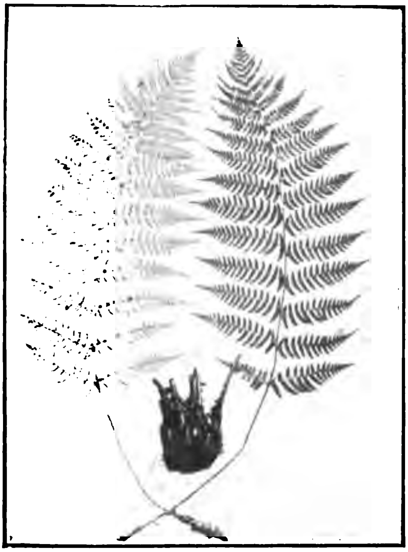

FIG. 1.—MARGINAL-FRUITED SHIELD-FERN (DRYOPTERIS MARGINALIS).

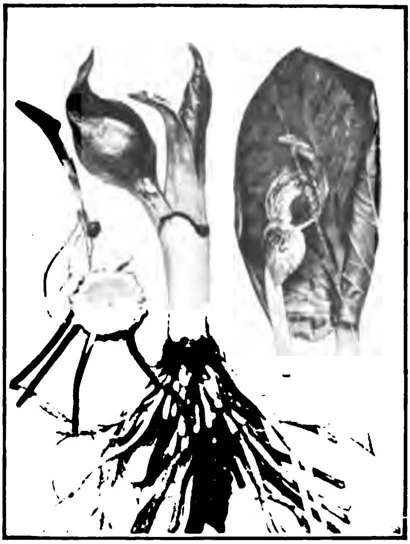

FIG. 2.—SKUNK-CABBAGE (SPATHYEMA FOETIDA).

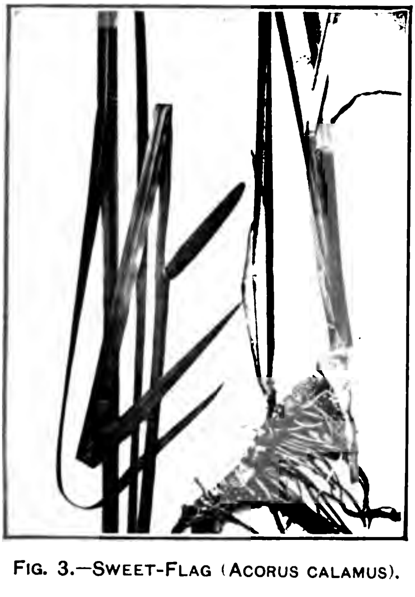

FIG. 3.—SWEET-FLAG (ACORUS CALAMUS).

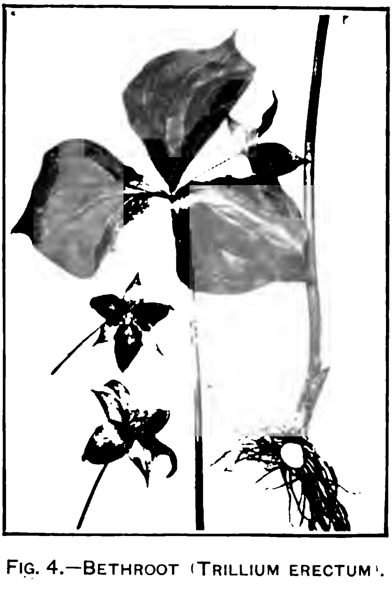

FIG. 4.—BETHROOT (TRILLIUM ERECTUM).

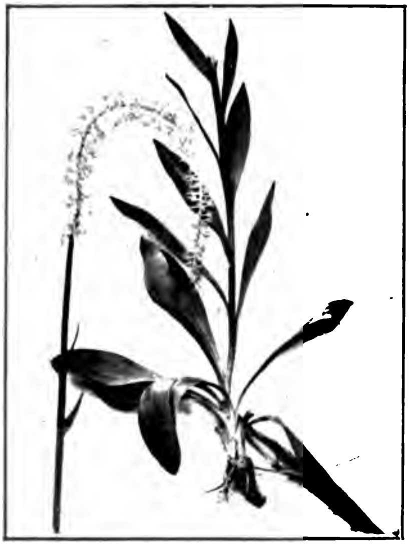

FIG. 1.—CHAMAELIRIUM (CHAMAELIRIUM LUTEUM).

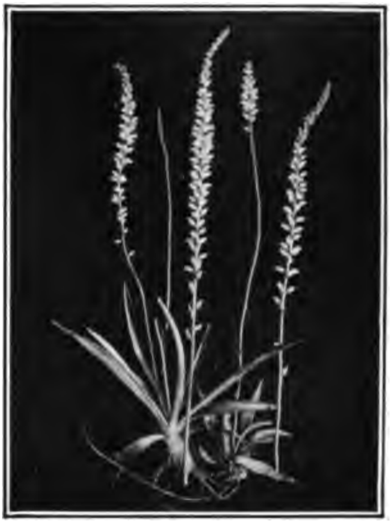

FIG. 2.—ALETRIS (ALETRIS FARINOSA).

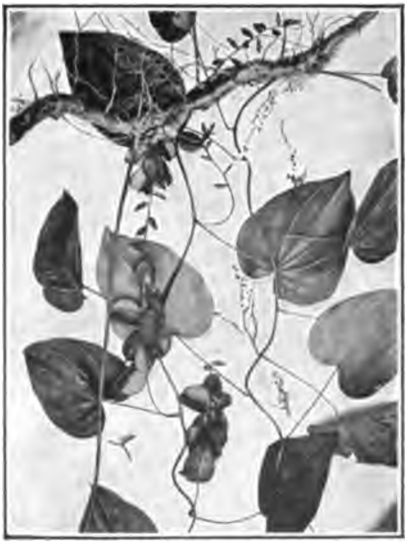

FIG. 3.—WILD YAM (DIOSCOREA VILLOSA).

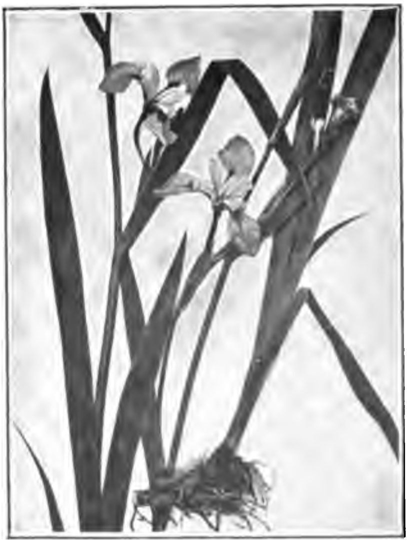

FIG. 4.—BLUE FLAG (IRIS VERSICOLOR).

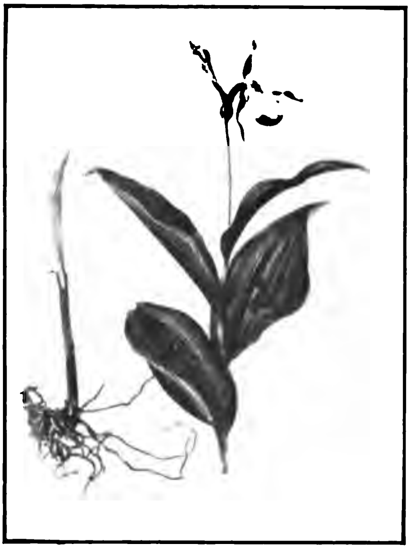

FIG. 1.—LARGE YELLOW LADY'S-SLIPPER (CYPRIPEDIUM HIRSUTUM).

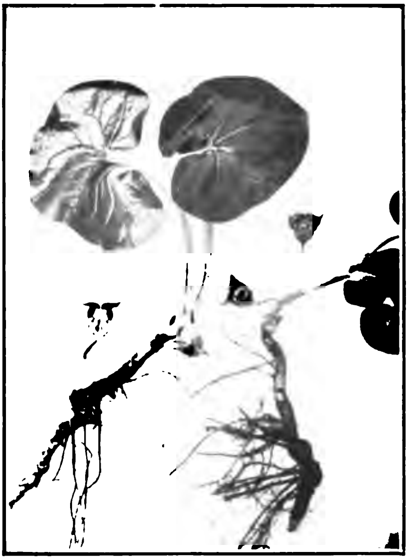

FIG. 2.—CANADA SNAKEROOT (ASARUM CANADENSE).

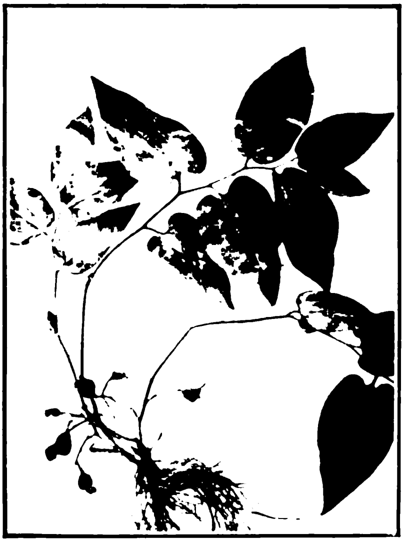

FIG. 3.—VIRGINIA SERPENTARIA (ARISTOLOCHIA SERPENTARIA).

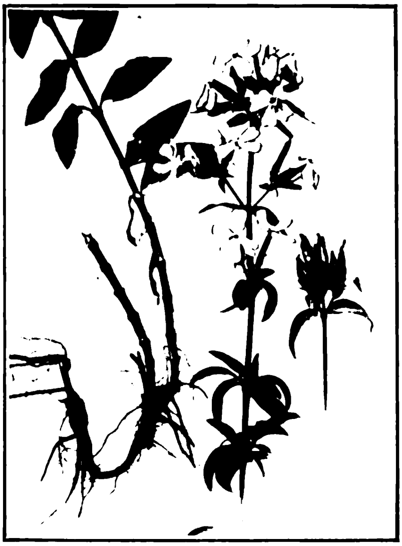

FIG. 4.—SOAPWORT (SAPONARIA OFFICINALIS).

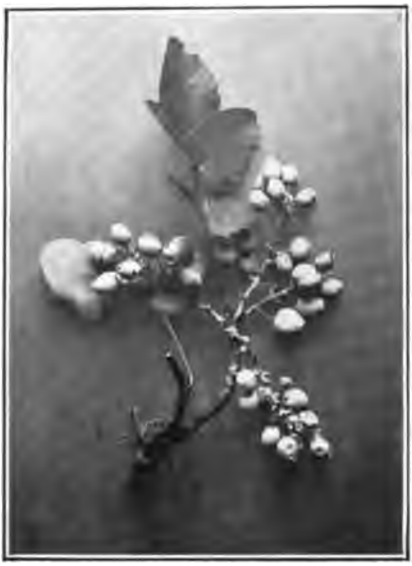

FIG. 1.—OREGON GRAPE (BERBERIS AQUIFOLIUM).

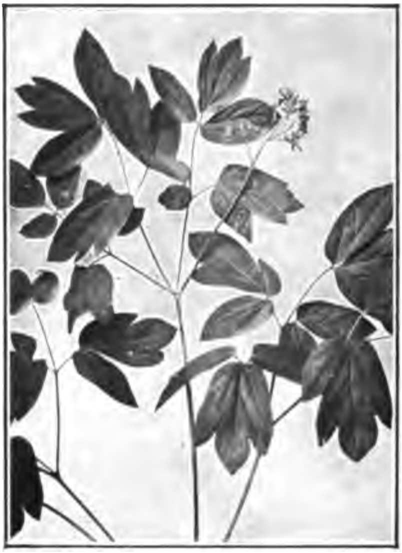

FIG. 2.—BLUE COHOSH (CAULOPHYLLUM THALICTROIDES).

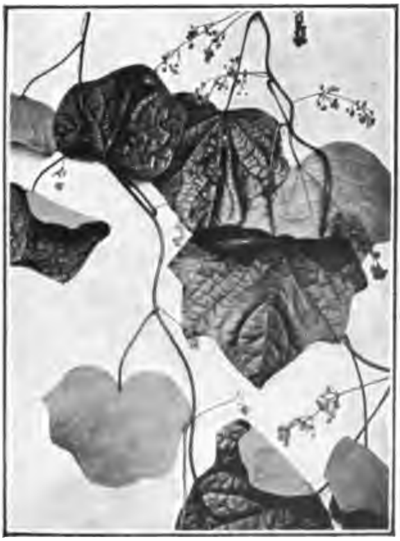

FIG. 3.—CANADA MOONSEED (MENISPERMUM CANADENSE).

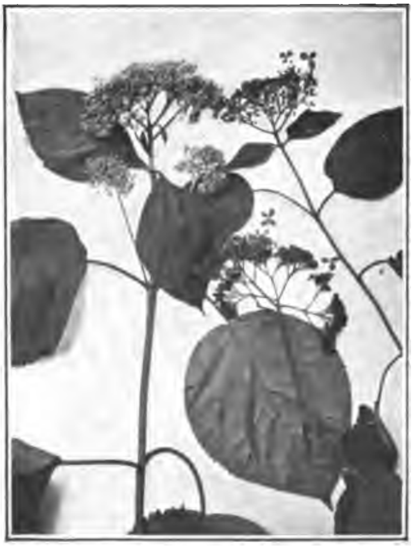

FIG. 4.—HYDRANGEA (HYDRANGEA ARBORESCENS).

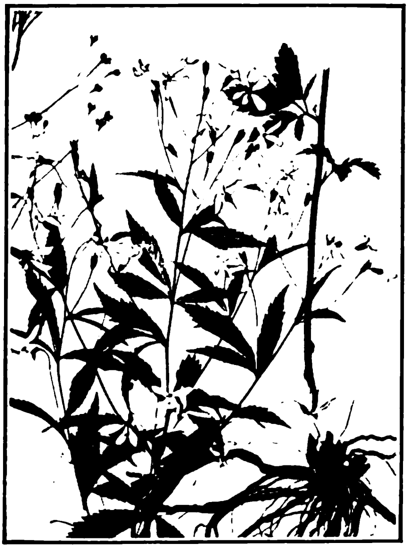

FIG. 1.—INDIAN-PHYSIC (PORTERANTHUS TRIFOLIATUS).

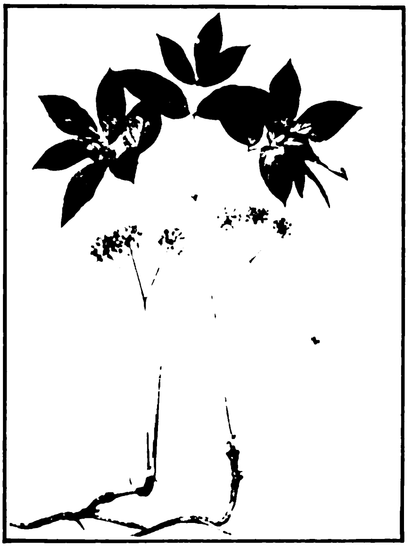

FIG. 2.—WILD SARSAPARILLA (ARALIA NUDICAULIS).

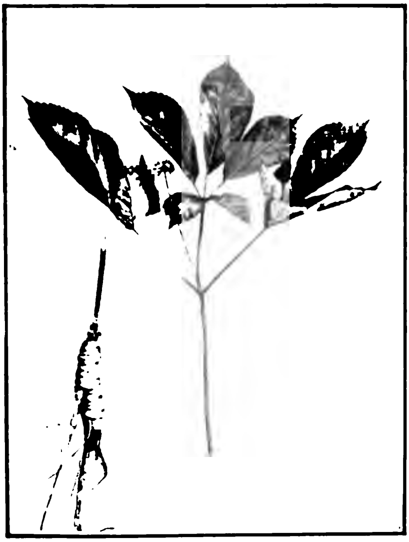

FIG. 3.—GINSENG (PANAX QUINQUEFOLIUM).

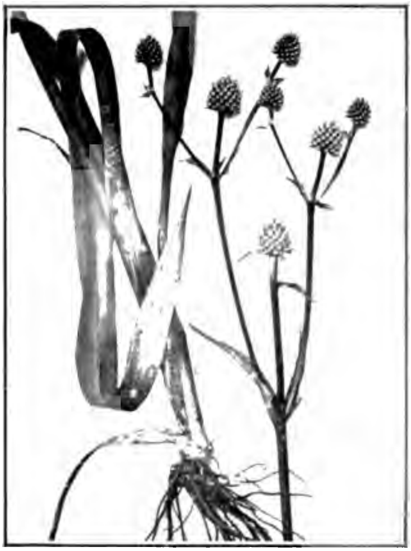

FIG. 4.—WATER-ERYNGO (ERYNGIUM YUCCIFOLIUM).

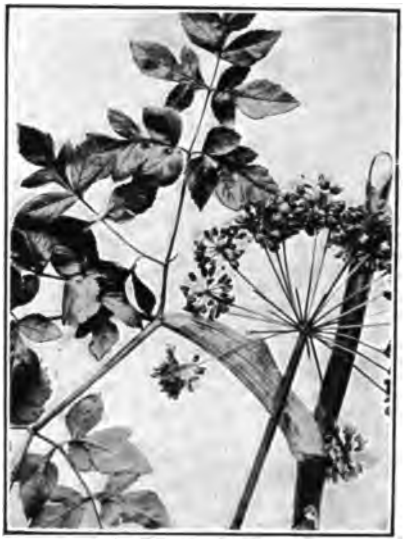

FIG. 1.—AMERICAN ANGELICA (ANGELICA ATROPURPUREA).

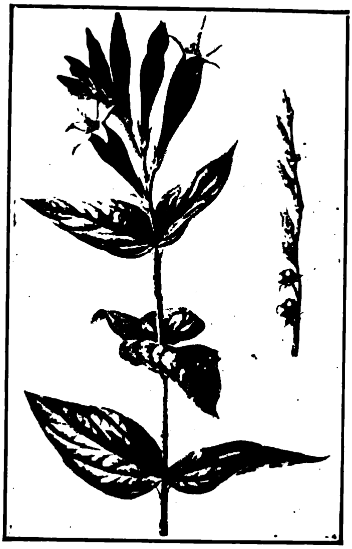

FIG. 2.—PINKROOT (SPIGELIA MARILANDICA).

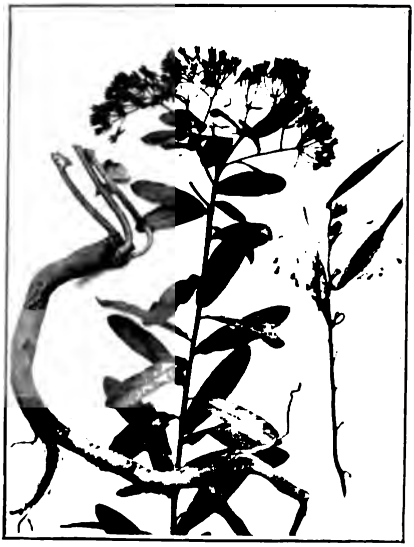

FIG. 3.—PLEURISY-ROOT (ASCLEPIAS TUBEROSA).

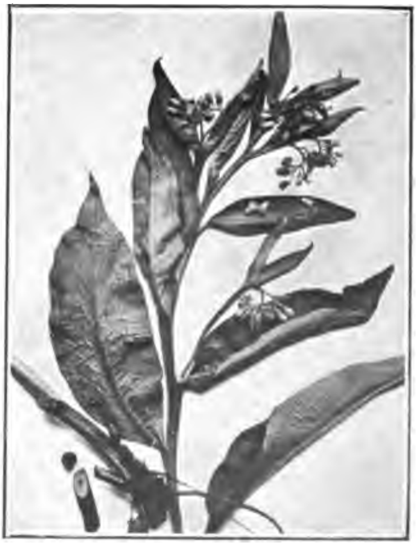

FIG. 4.—COMFREY (SYMPHYTUM OFFICINALE).

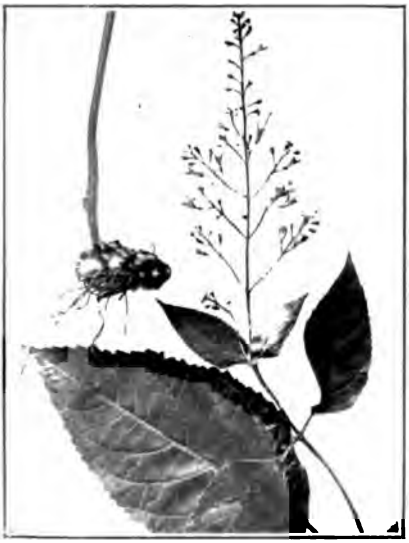

FIG. 1.—STONEROOT (COLLINSONIA CANADENSIS).

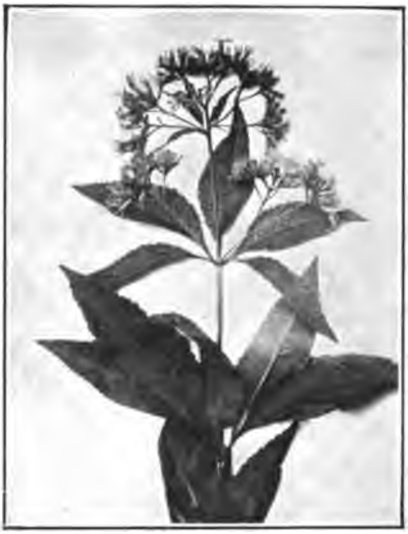

FIG. 2.—QUEEN-OF-THE-MEADOW (EUPATORIUM PURPUREUM).

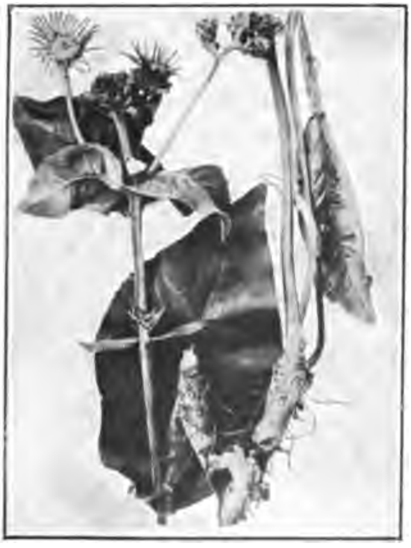

FIG. 3.—ELECAMPANE (INULA HELENIUM).

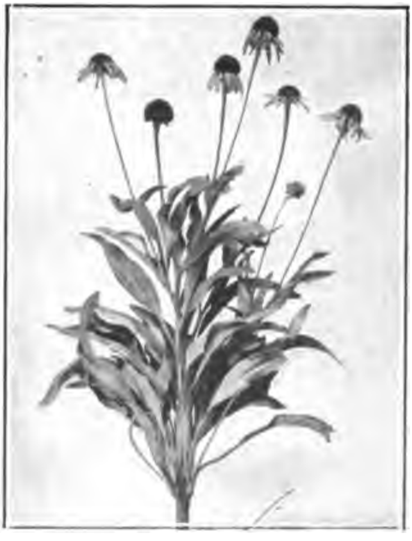

FIG. 4.—ECHINACEA (BRAUNERIA ANGUSTIFOLIA).

INDEX.

Page.

Acorus calamus. *See* Sweet-flag 16

Actaea race mosa. *See* Cohosh, black 35–36

Agropyron repens. *See* Couch-grass 12–13

Ague-grass. *See* Aletris 19–20

  root. *See* Aletris 19–20

Aletris, A. aurea, A. farinosa, A. lutea, and A. obovata. *See* Aletris, description 19–20

  description 19–20

  See also under Chamaelirium.

Aloe-root. *See* Aletris 19–20

Alumbloom. *See* Crane's-bill 44–45

  root. *See* Crane's-bill 44–45

Amy-root. *See* Indian hemp, black 55–56

Angelica, American, description 51

  atropurpurea and A. officinalis, European, garden, great, high, purple, and purple-stemmed. *See* Angelica, American 51

Apocynum, A. album, A. androsaemifolium, A. cannabinum, and A. pubescens. *See* Indian hemp, black 55–56

Apple, devil's, hog, and Indian. *See* May-apple 39–40

  May, description 39–40

Aralia californica, A. nudicaulis, and A. racemosa. *See* Sarsaparilla, wild 48–49

Archangelica atropurpurea. *See* Angelica, American 51

Arctium lappa. *See* Burdock 64–65

Arisaema triphyllum. *See* Turnip, wild 13–14

Aristolochia reticulata and A. serpentaria. *See* Serpentaria 26–27

Arum, three-leaved, and A. triphyllum. *See* Turnip, wild 13–14

Asarabacca, broad-leaved. *See* Snakeroot, Canada 25–26

Asarum and A. canadense. *See* Snakeroot, Canada 25–26

Asclepias, A. incarnata, A. syriaca, and A. tuberosa. *See* Pleurisy-root 56–57

Aspidium, A. filix-mas, and A. marginale. *See* Male-fern 11–12

Ass-ear. *See* Comfrey 57–58

Backwort. *See* Comfrey 57–58

Balm, horse, and ox. *See* Stoneroot 58–59

  Indian. *See* Bethroot 20–21

Baptisia, B. alba, and B. tinctoria. *See* Indigo, wild 43–44

Barberry, California, and holly-leaved. *See* Oregon grape 36–37

Bardane. *See* Burdock 64–65

Basket-fern. *See* Male-fern 11–12

Bathflower. *See* Bethroot 20–21

  wort. *See* Bethroot 20–21

Bear-corn. *See* Hellebore, American 18–19

Bear's-paw root. *See* Male-fern 11–12

Beaumont-root. *See* Culver's-root 59–60

Beewort. *See* Sweet-flag 16

Beggar's-buttons. *See* Burdock 64–65

Page.

Berberis, B. aquifolium, B. nervosa, B. pinnata, and B. repens. *See* Oregon grape 36–37
Bethroot, description 20–21
Birthroot. *See* Bethroot 20–21
  wort. *See* Bethroot 20–21
Bitterroot. *See* Indian hemp, black 55–56
Blackroot. *See* Culver's-root 59–60
  wort. *See* Comfrey 57–58
Blazingstar. *See* Chamaelirium and Aletris 17–18, 19–20
Bloodroot, description 40–41
Blowball. *See* Dandelion 60–61
Blueberry-root. *See* Cohosh, blue 37–38
Bog-onion. *See* Turnip, wild 13–14
Boneset, purple, spotted, and tall. *See* Queen-of-the-meadow 61–62
Bouncing-bet. *See* Soapwort 31
Bowman's-root. *See* Indian-physic; Indian hemp, black; and Culver's-root 42–43, 55–56, 59–60
Brake, knotty, and sweet. *See* Male-fern 11–12
Brauneria augustifolia. *See* Echinacea 63
Brinton-root. *See* Culver's-root 59–60
Broom, clover, indigo, and yellow. *See* Indigo, wild 43–44
Brown dragon. *See* Turnip, wild 13–14
Bruisewort. *See* Soapwort and Comfrey 31, 57–58
Bugbane. *See* Hellebore, American, and Cohosh, black 18–19, 35–36
  wort. *See* Hellebore, American, and Cohosh, black 18–19, 35–36
Bumblebee-root. *See* Bethroot 20–21
Burdock, description 64–65
Butter-dock. *See* Dock, yellow 27–29
Butterfly-weed. *See* Pleurisy-root 56–57
Button-snakeroot. *See* Water-eryngo 50–51

Cabbage, meadow, and swamp. *See* Skunk-cabbage 15
  skunk, description 15
Calamus. *See* Sweet-flag 16
  See also under Flag, blue.
Calomel, vegetable. *See* May-apple 39–40
Canada-root. *See* Pleurisy-root 56–57
Cancer-jalap. *See* Pokeweed 29–30
Cane, sweet. *See* Sweet-flag 16
Cankerroot. *See* Goldthread 34
  wort. *See* Dandelion 60–61
Cat's-foot. *See* Snakeroot, Canada 25–26
Caulophyllum and C. thalictroides. *See* Cohosh, blue 37–38
Centaury, ground. *See* Colombo, American 53–54
Chamaelirium, description 17–18
  luteum and C. obovale. *See* Chamaelirium, description 17–18
  See also under Aletris.
Chandler's-grass. *See* Couch-grass 12–13
Chickentoe. *See* Crawley-root 24–25
Chimney-pink. *See* Soapwort 31
Chocolate-flower. *See* Crane's-bill 44–45
Choctaw-root. *See* Indian hemp, black 55–56
Cimicifuga and C. racemosa. *See* Cohosh, black 35–36

Page.

- Cinnamon-sedge. *See* Sweet-flag 16
- Citronella. *See* Stoneroot 58–59
- Clover-broom. *See* Indigo, wild 43–44
- Coakum. *See* Pokeweed 29–30
- Cockle-button. *See* Burdock 64–65
- Cohosh, black, description 35–36
  - blue, description 37–38
- Colicroot. *See* Aletris; Yam, wild; and Snakeroot, Canada 19–20, 21–22, 25–26
- Collard. *See* Skunk-cabbage 15
- Collection of root drugs 10–11
- Collinsonia and C. canadensis. *See* Stoneroot 58–59
- Colombo, American, description 53–54
- Colt's-foot, false, and colt's-foot snakeroot. *See* Snakeroot, Canada 25–26
- Comfrey, description 57–58
- Common names of plants, confusion 10
- Coneflower, pale-purple. *See* Echinacea 63
- Coonroot. *See* Bloodroot 40–41
- Coptis and C. trifolia. *See* Goldthread 34
- Corallorhiza and C. odontorhiza. *See* Crawley-root 24–25
- Coralroot, late, small, and small-flowered. *See* Crawley-root 24–25
- Corn, bear. *See* Hellebore, American 18–19
  - crow. *See* Aletris 19–20
  - snakeroot. *See* Water-eryngo 50–51
- Cotton, wild. *See* Indian hemp, black 55–56
- Couch-grass, description 12–13
- Crane's-bill, description 44–45
  - spotted, and wild. *See* Crane's-bill, description 44–45
- Crawley. *See* Crawley-root 24–25
- Crawley-root, description 24–25
- Crow-corn. *See* Aletris 19–20
  - foot. *See* Crane's-bill 44–45
  - soap. *See* Soapwort 31
- Cuckold-dock. *See* Burdock 64–65
- Culver's-physic. *See* Culver's-root 59–60
  - root, description 59–60
- Curcuma, Ohio. *See* Goldenseal 31–33
- Cypripedium, C. hirsutum, C. parviflorum, and C. pubescens. *See* Lady's-slipper 23–24

- Daffydown-dilly. *See* Bethroot 20–21
- Daisy, Irish. *See* Dandelion 60–61
- Dandelion, description 60–61
- Dealers in root drugs, communication necessary 11
  - samples to be sent 11
- Descriptions of plants furnishing root drugs 11–65
  - root drugs 11–65
  - scope of 11
- Devil's-apple. *See* May-apple 39–40
  - bit. *See* Chamaelirium and Aletris 17–18, 19–20
  - bite. *See* Hellebore, American 18–19
  - bones. *See* Yam, wild 21–22
  - ear. *See* Turnip, wild 13–14
  - grass. *See* Couch-grass 12–13

Page.
Dioscorea, D. villosa, and D. villosa var. glabra. *See* Yam, wild 21–22
Dishcloth. *See* Bethroot 20–21
Dock, bitter, blunt-leaved, broad-leaved, butter, common, curled, narrow, and sour. *See* Dock, yellow 27–29
  cuckold. *See* Burdock 64–65
  elf, and velvet. *See* Elecampane 62–63
  yellow, description 27–29
Dogbane, riverbank, and velvet. *See* Indian hemp, black 55–56
  grass. *See* Couch-grass 12–13
Doon-head-clock. *See* Dandelion 60–61
Dovefoot. *See* Crane's-bill 44–45
Dracontium and D. foetidum. *See* Skunk-cabbage 15
Dragon, brown, and dragon-turnip. *See* Turnip, wild 13–14
Dragon's-claw. *See* Crawley-root 24–25
Dropwort, western. *See* Indian-physic 42–43
Dryopteris filix-mas and D. marginalis. *See* Male-fern 11–12
Duckretter. *See* Hellebore, American 18–19
Duck's-foot. *See* May-apple 39–40
Durfa-grass. *See* Couch-grass 12–13
Durfee-grass. *See* Couch-grass 12–13
Dutch-grass. *See* Couch-grass 12–13

Earth-gall. *See* Hellebore, American 18–19
Echinacea angustifolia. *See* Echinacea, description 63
  description 63
Elder, horse. *See* Elecampane 62–63
Elecampane, description 62–63
Elf-dock. *See* Elecampane 62–63
  wort. *See* Elecampane 62–63
Eryngium, E. aquaticum, and E. yuccifolium. *See* Water-eryngo 50–51
Eryngo. *See* Water-eryngo 50–51
Eryngo, water, description 50–51
Eupatorium maculatum and E. purpureum. *See* Queen-of-the-meadow.
Explanation of plates 68
  term "root drugs" 9
Eye-balm. *See* Goldenseal 31–33
  root. *See* Goldenseal 31–33

Fern, basket, evergreen wood, male shield, and marginal-fruited shield. *See* Male-fern 11–12
  male, description 11–12
Feverroot. *See* Crawley-root 24–25
Fin's-grass. *See* Couch-grass 12–13
Five-fingers. *See* Ginseng 49–50
Flag, blue, description 22–23
  See also under Sweet-flag.
  lily, and water. *See* Flag, blue 22–23
  myrtle. *See* Sweet-flag 16
  poison. *See* Flag, blue 22–23
  See also under Sweet-flag.
  rattlesnake. *See* Water-eryngo 50–51
  sweet, description 16
  See also under Flag, blue.

Page.

Flax, mountain. *See* Snakeroot, Seneca 45–47
Fleur-de-lis, American. *See* Flag, blue 22–23
Flower-de-luce, American. *See* Flag, blue 22–23
Fluctuation in prices of drugs 11
Fortune-teller. *See* Dandelion 60–61
Frasera, F. carolinensis, and F. walteri. *See* Colombo, American 53–54
Fuller's-herb. *See* Soapwort 31

Garget. *See* Pokeweed 29–30
Gelsemium and G. sempervirens. *See* Jasmine, yellow 51–52
Gentian, yellow. *See* Colombo, American 53–54
Geranium and G. maculatum, spotted, and wild. *See* Crane's-bill 44–45
Gillenia, G. stipulacea, and G. trifoliata. *See* Indian-physic 42–43
Gilliflower, mock. *See* Soapwort 31
Ginger, Indian, and wild. *See* Snakeroot, Canada 25–26
Ginseng, American. *See* Ginseng, description 49–50
 blue, and yellow. *See* Cohosh, blue 37–38
 description 49–50
Goldenseal, description 31–33
Goldthread, description 34
Gowan, horse, and yellow. *See* Dandelion 60–61
Grape, Oregon, description 36–37
 Rocky Mountain. *See* Oregon grape 36–37
Grass, Chandler's, creeping wheat, devil's, dog, durfa, Durfee, Dutch, Fin's, quack, quake, quick, quitch, scutch, twitch, wheat, and witch. *See* Couch-grass 12–13
 couch, description 12–13
 myrtle, and sweet. *See* Sweet-flag 16
Gravelroot and Indian gravelroot. *See* Queen-of-the-meadow 61–62
Ground-centaury. *See* Colombo, American 53–54
 lemon. *See* May-apple 39–40
 raspberry. *See* Goldenseal 31–33
 squirrel pea. *See* Twinleaf 38–39
Gum-plant. *See* Comfrey 57–58

Hardock. *See* Burdock 64–65
Healing-herb. *See* Comfrey 57–58
Heart-snakeroot. *See* Snakeroot, Canada 25–26
Hedge-pink. *See* Soapwort 31
Hellebore, American, description 18–19
 big, false, green, swamp, and white. *See* Hellebore, American 18–19
 fetid. *See* Skunk-cabbage 15
Helmetpod. *See* Twinleaf 38–39
Helonias, description 17–18
 dioica. *See* Chamaelirium or Helonias, description 17–18
Hemp, American, and Canadian. *See* Indian hemp, black 55–56
 black Indian, description 55–56
Hog-apple. *See* May-apple 39–40
Holly, mountain. *See* Oregon grape 36–37
Horse-balm and horseweed. *See* Stoneroot 58–59
 elder and horseheal. *See* Elecampane 62–63
 gowan. *See* Dandelion 60–61
Horsefly-weed. *See* Indigo, wild 43–44

Page.
Hurr-bur. *See* Burdock 64–65
Huskwort. *See* Aletris 19–20
Hydrangea arborescens and wild hydrangea. *See* Hydrangea, description 41–42
    description 41–42
Hydrastis and H. canadensis. *See* Goldenseal 31–33

Indian apple. *See* May-apple 39–40
    balm and Indian shamrock. *See* Bethroot 20–21
    dye, Indian turmeric, and Indian-paint, yellow. *See* Goldenseal 31–33
    ginger. *See* Snakeroot, Canada 25–26
    gravelroot. *See* Queen-of-the-meadow 61–62
    hemp, black, description 55–56
    hippo. *See* Indian-physic 42–43
    lettuce. *See* Colombo, American 53–54
    paint, red. *See* Bloodroot 40–41
    physic, description 42–43
        See also Indian hemp, black.
    pink. *See* Pinkroot 52–53
    poke. *See* Hellebore, American 18–19
    posy. *See* Pleurisy-root 56–57
    root. *See* Sarsaparilla, wild 48–49
    shoe, yellow. *See* Lady's-slipper 23–24
    turnip. *See* Turnip, wild 13–14
Indigo, American, white wild, and yellow; indigo-broom and indigo-weed. *See* Indigo, wild 43–44
    wild, description 43–44
Inkberry and red inkberry. *See* Pokeweed 29–30
Introduction to bulletin 9–10
Inul. *See* Elecampane 62–63
Inula and I. helenium. *See* Elecampane 62–63
Ipecac, American, and false. *See* Indian-physic 42–43
Iris and I. versicolor. *See* Flag, blue 22–23
Itchweed. *See* Hellebore, American 18–19

Jack-in-the-pulpit. *See* Turnip, wild 13–14
Jalap, cancer. *See* Pokeweed 29–30
Jasmine, Carolina. *See* Jasmine, yellow 51–52
    yellow, description 51–52
Jaundice-root. *See* Goldenseal 31–33
Jeffersonia and J. diphylla. *See* Twinleaf 38–39
Jessamine, Carolina. *See* Jasmine, yellow 51–52
    yellow, description 51–52
Joe-pye-weed and spotted joe-pye-weed. *See* Queen-of-the-meadow 61–62

Kidneyroot. *See* Queen-of-the-meadow 61–62
King-of-the-meadow. *See* Queen-of-the-meadow 61–62
Knitback. *See* Comfrey 57–58
Knobgrass. *See* Stoneroot 58–59
    root. *See* Stoneroot 58–59
    weed. *See* Stoneroot 58–59
Knotroot. *See* Stoneroot 58–59

Page.
Lady-by-the-gate. *See* Soapwort 31
Lady's-slipper, description 23–24
    large yellow, small yellow, and yellow. *See* Lady's-slipper, description 23–24
Lappa and L. major. *See* Burdock 64–65
Latherwort. *See* Soapwort 31
Lemon, ground, and wild. *See* May-apple 39–40
Leptandra and L. virginica. *See* Culver's-root 59–60
Lettuce, Indian. *See* Colombo, American 53–54
Licorice, wild. *See* Sarsaparilla, wild 48–49
Life-of-man. *See* Sarsaparilla, wild 48–49
Lily, flag, liver, and snake. *See* Flag, blue 22–23
    wood. *See* Bethroot 20–21
Liver-lily. *See* Flag, blue 22–23
London-pride. *See* Soapwort 31
Lords-and-ladies. *See* Turnip, wild 13–14

Mahonia, trailing. *See* Oregon grape 36–37
Male-fern, description 11–12
    nervine. *See* Lady's slipper 23–24
    shield-fern. *See* Male-fern 11–12
Mandrake, American, and wild. *See* May-apple 39–40
Maple, vine. *See* Moonseed, Canada 40
Marsh-milkweed. *See* Queen-of-the-meadow 61–62
    turnip. *See* Turnip, wild 13–14
Masterwort. *See* Angelica, American 51
May-apple, description 39–40
Meadow-cabbage. *See* Skunk-cabbage 15
    pride. *See* Colombo, American 53–54
    turnip. *See* Turnip, wild 13–14
Medicinal uses of root drugs 9
Menispermum and M. canadense. *See* Moonseed, Canada 40
Methods of cleaning and drying root drugs 10
Milkweed, common, orange, swamp, and yellow. *See* Pleurisy-root 56–57
    marsh. *See* Queen-of-the-meadow 61–62
    See also Indian hemp, black.
Moccasin-flower, yellow. *See* Lady's-slipper 23–24
Mock-gilliflower. *See* Soapwort 31
Monkey-flower. *See* Lady's-slipper 23–24
Moonseed, Canada, description 40
Motherwort. *See* Queen-of-the-meadow 61–62
Mountain-flax. *See* Snakeroot, Seneca 45–47
    holly. *See* Oregon grape 36–37
Mouthroot. *See* Goldthread 34
Myrtle-flag, myrtle-grass, and myrtle-sedge. *See* Sweet-flag 16
    sweet. *See* Sweet-flag 16

Names of plants, confusion 10
Nerve-root. *See* Lady's-slipper 23–24
Nervine, male. *See* Lady's-slipper 23–24
Nettle-potato. *See* Stillingia 47–48

Page.
Niggerhead. *See* Echinacea 63
  weed. *See* Queen-of-the-meadow 61–62
Nightshade, American. *See* Pokeweed 29–30
Noah's-ark, yellow. *See* Lady's-slipper 23–24
Nosebleed. *See* Bethroot 20–21

Old-maid's-nightcap. *See* Crane's-bill 44–45
    pink. *See* Soapwort 31
  man's-root. *See* Sarsaparilla, wild 48–49
One-o'clock. *See* Dandelion 60–61
Onion, bog. *See* Turnip, wild 13–14
Orange-blossom. *See* Bethroot 20–21
  root. *See* Goldenseal and Pleurisy-root 31, 56–57
Oregon grape, description 36–37
Ox-balm. *See* Stoneroot 58–59

Panax quinquefolium. *See* Ginseng 49–50
Pappoose-root. *See* Cohosh, blue 37–38
Parilla, yellow. *See* Moonseed, Canada 40
Pauson. *See* Bloodroot 40–41
Pea, ground-squirrel. *See* Twinleaf 38–39
Pelican-flower. *See* Serpentaria 26–27
Pepper-turnip and wild pepper. *See* Turnip, wild 13–14
Petty-morrel. *See* Sarsaparilla, wild 48–49
Phlox, Carolina, and P. ovata. *See under* Pinkroot 52–53
  woods. *See* Soapwort 31
Physic-root. *See* Culver's-root 59–60
Phytolacca, P. americana, and P. decandra. *See* Pokeweed 29–30
Pigeon-berry. *See* Pokeweed 29–30
Pink, Boston, chimney, hedge, and old-maid's. *See* Soapwort 31
  Carolina, Indian, and Maryland. *See* Pinkroot, description 52–53
Pinkroot, Carolina, and East Tennessee. *See* Pinkroot, description 52–53
  description 52–53
Plant names, confusion 10
Plants furnishing root drugs 11–65
    descriptions 11–65
Plates, explanation 68
Pleurisy-root, description 56–57
Pocan. *See* Pokeweed 29–30
Pockweed. *See* Skunk-cabbage 15
Podophyllum and P. peltatum. *See* May-apple 39–40
Poison-flag. *See* Flag, blue 22–23
  See also under Sweet-flag.
Poke and Virginian poke. *See* Pokeweed 29–30
  Indian. *See* Hellebore, American 18–19
  stinking. *See* Skunk-cabbage 15
Pokeweed, description 29–30
Polecat-weed. *See* Skunk-cabbage 15
Polygala senega and P. senega var. latifolia. *See* Snakeroot, Seneca 45–47
Porteranthus stipulatus and P. trifoliatus. *See* Indian-physic 42–43
Potato, nettle. *See* Stillingia 47–48
Preparation of root drugs for market 10–11

Page.
Prices, approximate range 11
    conditions affecting 11
    fluctuations 11
    paid to collectors 11
Priest's-pintle. *See* Turnip, wild 13–14
Puccoon, red, white, and puccoon-root. *See* Bloodroot 40–41
    yellow. *See* Goldenseal 31–33
Pyramid-flower and pyramid-plant. *See* Colombo, American 53–54

Quack-grass. *See* Couch-grass 12–13
Quake-grass. *See* Couch-grass 12–13
Queen-of-the-meadow, description 61–62
Queen's-delight and queen's-root. *See* Stillingia 47–48
Quick-grass. *See* Couch-grass 12–13
Quillwort. *See* Queen-of-the-meadow 61–62
Quitch-grass. *See* Couch-grass 12–13

Rabbit's-root. *See* Sarsaparilla, wild 48–49
Raccoon-berry. *See* May-apple 39–40
Raspberry, ground. *See* Goldenseal 31–33
Rattlebush. *See* Indigo, wild 43–44
Rattleroot. *See* Cohosh, black 35–36
Rattle-snakeroot, rattletop, and rattleweed. *See* Cohosh, black 35–36
Rattlesnake-flag, rattlesnake-master, and rattlesnake-weed. *See* Water-eryngo 50–51
    root. *See* Snakeroot, Seneca 45–47
Red-benjamin. *See* Bethroot 20–21
    berry. *See* Ginseng 49–50
    root. *See* Bloodroot 40–41
    weed. *See* Pokeweed 29–30
Rheumatism-root. *See* Yam, wild, and Twinleaf 21–22, 38–39
    weed. *See* Indian hemp, black 55–56
Richleaf. *See* Stoneroot 58–59
Richweed. *See* Cohosh, black, and Stoneroot 35–36, 58–59
Riverbank-dogbane. *See* Indian hemp, black 55–56
Rocky Mountain grape. *See* Oregon grape 36–37
Root drugs, cleaning 10
    collection 10–11
    dealers, communication necessary 11
        samples to be sent 10–11
    descriptions 11–65
    drying, method 10
        time required 10
    explanation of term 9
    medicinal uses 9
    methods of cleaning and drying 10
    number described 9
    official and nonofficial 9
    packing for shipment 10
    plants furnishing 11–65
    preparation for market 10–11

Page.
Root drugs, samples for dealers 10, 11
  time for collecting 10
    required for drying 10
Ruellia ciliosa. *See under* Pinkroot 52–53
Rumex, R. crispus, and R. obtusifolius. *See* Dock, yellow 27–29
Rush, sweet. *See* Sweet-flag 16

Sampson-root. *See* Echinacea 63
Sang. *See* Ginseng 49–50
Sangree-root. *See* Serpentaria 26–27
Sangrel. *See* Serpentaria 26–27
Sanguinaria and S. canadensis. *See* Bloodroot 40–41
Saponaria and S. officinalis. *See* Soapwort 31
Saponary. *See* Soapwort 31
Sarsaparilla, American, false, and Virginian. *See* Sarsaparilla, wild 48–49
  Texas, and yellow. *See* Moonseed, Canada 40
  wild, description 48–49
Scabwort. *See* Elecampane 62–63
Scoke. *See* Pokeweed 29–30
Scourwort. *See* Soapwort 31
Scutch-grass. *See* Couch-grass 12–13
Sedge, cinnamon, myrtle, and sweet. *See* Sweet-flag 16
Segg, sweet. *See* Sweet-flag 16
Seneca-root. *See* Snakeroot, Seneca 45–47
Senega. *See* Snakeroot, Seneca 45–47
Serpentaria, description 26–27
  Texas and Virginia. *See* Serpentaria 26–27
Serpentary. *See* Serpentaria 26–27
Seven-barks. *See* Hydrangea 41–42
Shameface. *See* Crane's-bill 44–45
Shamrock, Indian. *See* Bethroot 20–21
Sheepweed. *See* Soapwort 31
Shield-fern, male, and marginal-fruited. *See* Male-fern 11–12
Shoofly. *See* Indigo, wild 43–44
Shotbush. *See* Sarsaparilla, wild 48–49
Silverleaf. *See* Stillingia 47–48
Skunk-cabbage, description 15
  weed. *See* Skunk-cabbage 15
Slippery-root. *See* Comfrey 57–58
Slunkweed. *See* Queen-of-the-meadow 61–62
Snagrel. *See* Serpentaria 26–27
Snakebite. *See* Bloodroot 40–41
  lily. *See* Flag, blue 22–23
  root, black. *See* Snakeroot, Canada, and Cohosh, black 25–26, 35–36
    button, and corn. *See* Water-eryngo 50–51
    Canada, description 25–26
    colt's foot, heart, southern, and Vermont. *See* Snakeroot, Canada 25–26
    rattle. *See* Cohosh, black 35–36
    Red River, Texas, and Virginia. *See* Serpentaria 26–27
    Seneca, description 45–47
    Senega. *See* Snakeroot, Seneca 45–47

Page.

- Snakeweed. *See* Serpentaria 26–27
  - weed, black. *See* Snakeroot, Canada 25–26
- Soaproot. *See* Soapwort, description 31
  - wort, common. *See* Soapwort, description 31
    - description 31
- Spathyema foetida. *See* Skunk-cabbage 15
- Speedwell, tall. *See* Culver's-root 59–60
- Spiceberry. *See* Sarsaparilla, wild 48–49
- Spigelia and S. marilandica. *See* Pinkroot 52–53
- Spignet. *See* Sarsaparilla, wild 48–49
- Spikenard, American, California, and small. *See* Sarsaparilla, wild 48–49
- Squawflower. *See* Bethroot 20–21
  - root. *See* Bethroot; Cohosh, black; and Cohosh, blue 20–21, 35–36, 37–38
- Starbloom. *See* Pinkroot 52–53
  - grass. *See* Aletris 19–20
  - wort. *See* Chamaelirium and Aletris 17–18, 19–20
  - wort, drooping. *See* Chamaelirium 17–18
    - mealy. *See* Aletris 19–20
    - yellow. *See* Elecampane 62–63
- Starchwort. *See* Turnip, wild 13–14
- Stick-button. *See* Burdock 64–65
- Stillingia, description 47–48
    - sylvatica. *See* Stillingia, description 47–48
- Stoneroot, description 58–59
- Stork's-bill. *See* Crane's-bill 44–45
- Sunflower, wild. *See* Elecampane 62–63
- Swallowwort, orange. *See* Pleurisy-root 56–57
- Swamp-cabbage. *See* Skunk-cabbage 15
  - hellebore. *See* Hellebore, American 18–19
  - milkweed. *See* Pleurisy-root 56–57
  - turnip. *See* Turnip, wild 13–14
- Sweet-betty, and sweet-william, wild. *See* Soapwort 31
  - cane, sweet grass, sweet myrtle, sweetroot, sweet rush, sweet sedge, and sweet segg. *See* Sweet-flag 16
  - flag, description 16
    See also under Flag, blue.
  - slumber. *See* Bloodroot 40–41
- Symphytum and S. officinale. *See* Comfrey 57–58
- Symplocarpus foetidus. *See* Skunk-cabbage 15

- Taraxacum, T. dens-leonis, T. officinale, and T. taraxacum. *See* Dandelion 60–61
- Tetterwort. *See* Bloodroot 40–41
- Tickleweed. *See* Hellebore, American 18–19
- Trillium and T. erectum, ill-scented, purple, and red. *See* Bethroot 20–21
- Triticum and T. repens. *See* Couch-grass 12–13
- True-love. *See* Bethroot 20–21
- Trumpet-flower, evening. *See* Jasmine, yellow 51–52
  - weed. *See* Queen-of-the-meadow 61–62
- Tuberroot. *See* Pleurisy-root 56–57
- Turkey-claw. *See* Crawley-root 24–25
- Turmeric. *See* Bloodroot 40–41

Page.

Turmeric, Indian, and turmeric-root. *See* Goldenseal 31–33
Turnip, dragon, Indian, marsh, meadow, pepper, and swamp. *See* Turnip, wild 13–14
wild, description 13–14
Twinleaf, description 38–39
Twitch-grass. *See* Couch-grass 12–13

Umbil-root and yellow umbil. *See* Lady's-slipper 23–24
Umbrella-plant. *See* May-apple 39–40
Unicorn-plant. *See* Aletris 19–20
root. *See* Chamaelirium and Aletris 17–18, 19–20
root, false. *See* Chamaelirium 17–18
true. *See* Aletris 19–20
Unicorn's-horn. *See* Chamaelirium and Aletris 17–18, 19–20

Valerian, American. *See* Lady's-slipper 23–24
Vegetable calomel. *See* May-apple 39–40
Venus'-cup and Venus'-shoe. *See* Lady's-slipper 23–24
Veratrum, V. album, and V. viride, American, green, and true. *See* Hellebore, American 18–19
Veronica, tall, and V. virginica. *See* Culver's-root 59–60
Vine-maple. *See* Moonseed, Canada 40

Wake-robin. *See* Turnip, wild 13–14
robin, ill-scented, purple, and red. *See* Bethroot 20–21
Water-eryngo, description 50–51
flag. *See* Flag, blue 22–23
Wheat-grass and creeping wheat-grass. *See* Couch-grass 12–13
Whiteroot. *See* Pleurisy-root 56–57
Whorlywort. *See* Culver's-root 59–60
Windroot. *See* Pleurisy-root 56–57
Witch-grass. *See* Couch-grass 12–13
Woodbine, Carolina wild. *See* Jasmine, yellow 51–52
Wood-fern, evergreen. *See* Male-fern 11–12
lily. *See* Bethroot 20–21
Woods-phlox. *See* Soapwort 31
World's-wonder. *See* Soapwort 31
Wormgrass, wormweed, and American wormroot. *See* Pinkroot 52–53

Yam, wild, description 21–22
Yellow-eye. *See* Goldenseal 31–33
root. *See* Goldenseal, Goldthread, and Twinleaf 31–33, 34, 38–39
Yellows. *See* Lady's-slipper 23–24

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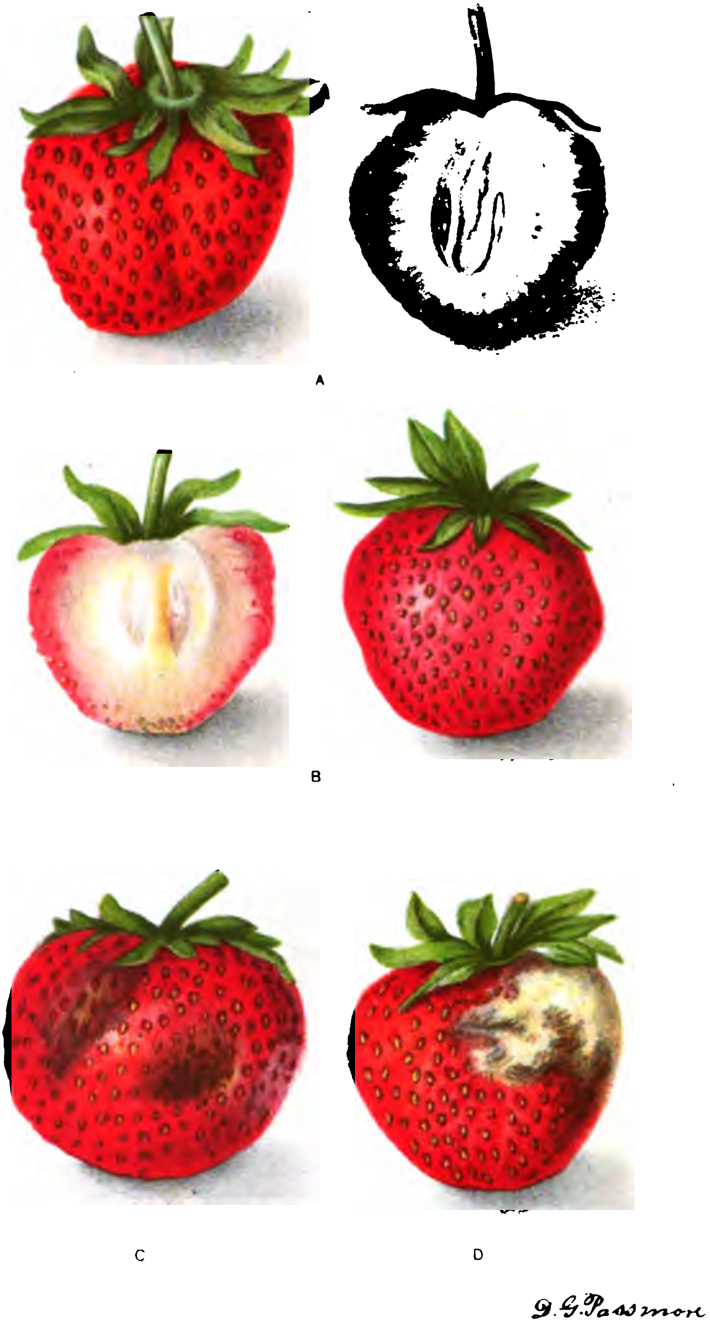

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BUREAU OF PLANT INDUSTRY—BULLETIN NO. 108.

B. T. GALLOWAY, *Chief of Bureau.*

THE COLD STORAGE OF SMALL FRUITS.

BY

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FORMERLY ASSISTANT POMOLOGIST, FIELD
INVESTIGATIONS IN POMOLOGY.

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[a] Resigned in April, 1906.

LETTER OF TRANSMITTAL.

United States Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., April 12, 1907.

Sir: I have the honor to transmit herewith a manuscript entitled "The Cold Storage of Small Fruits" and to recommend that it be published as Bulletin No. 108 of the series of this Bureau. This bulletin was prepared by Mr. S. H. Fulton, formerly Assistant Pomologist in Field Investigations in Pomology, and has been submitted by Messrs. William A. Taylor and G. Harold Powell, Pomologists in Charge of Field Investigations in Pomology, with a view to publication.

The subject is an important one to small fruit growers in many portions of the country, and it is believed that the results of the investigations set forth will be found useful by suggesting ways of prolonging the marketing season and thus conducing to a better distribution of the product, as well as by indicating some of the risks that are involved in attempts to hold such products longer than their inherent physical characteristics permit. The fundamental importance of careful attention to the details of harvesting, packing, and handling is emphasized by the results of this work, as well as the necessity of proper ventilation of rooms and isolation of products in storage houses to preserve the normal color, texture, and flavor of these delicate fruits.

The work covered by this report has been done by Mr. Fulton, while the investigations of the gases that accumulate in packages of stored fruit and of the effect of oxygen gas upon stored fruit have been made by Mr. H. C. Gore, of the Bureau of Chemistry, in cooperation with this Bureau.

The accompanying illustrations are necessary to a full understanding of the text.

Respectfully,

B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

CONTENTS.

Page.
Introduction 7
Outline of experiments in small-fruit storage 10
The influence of soil and climatic conditions on the keeping quality of small fruits 11
The influence of the time of picking on the keeping quality of small fruits... 12
Storage house temperatures for small fruits................................ 12
The freezing of small fruits in cold storage 13
The influence of the type of package on the keeping quality of small fruits ... 14
Composition of the air in different types of packages..................... 15
The influence of the wrapper on the keeping quality of small fruits........... 17
The influence of oxygen gas on the keeping quality of small fruits............ 18
The influence on the keeping quality of careful handling and of storing small fruits soon after picking 19
The length of time small fruits keep in cold storage 20
The behavior of small fruits when withdrawn from cold storage 21
Summary 21
Description of plates.. 26
Index 27

ILLUSTRATIONS.

PLATES.

Page.

PLATE I. Gandy strawberries. *A*, after twenty-one days in cold storage at a temperature of 32° F. *B*, after seven months in a frozen condition in storage at a temperature of 12° F. *C*, showing discoloration of the fruit from bruising. *D*, showing mold forming on a bruised spot .... Frontispiece.

II. Packages and wrappers used on berries in cold storage. Fig. 1.—Cartons in which fruit was frozen. Fig. 2.—A box of strawberries wrapped with japanin paper and one unwrapped. Fig. 3.—Black raspberries wrapped with japanin paper and unwrapped, packed in a Hallock crate 26

III. Black mold on strawberries and black raspberries in cold storage. Figs. 1 and 2.—Black mold on black raspberries. Figs. 3 and 4.—Black mold on strawberries 26

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THE COLD STORAGE OF SMALL FRUITS.

INTRODUCTION.

The beneficial influence of cold storage on fruit growing in America has not been shared equally by all branches of the industry. Some kinds of fruit are better adapted to storing in cold temperatures than others, and are in active demand through a longer season. Winter apples and pears can be kept in good condition for long periods in cold storage, and a large part of the late apple and pear crops of the United States is now held in cold storage annually to insure a supply of these fruits in good condition throughout the winter and spring months. Upon the other hand, berries and other small fruits are not stored to nearly so great an extent on account of their highly perishable nature.

The storage of small fruits is a problem somewhat different from the storage of the more durable fruits. Winter apples and pears are usually too hard and immature when stored to be fit for immediate consumption. Cold storage insures the safe keeping of these fruits for long periods, and under proper management brings out their finest flavor and quality. The fruits ripen slowly in the low temperature of the storage house, the acids diminish, the starch changes to sugar if the transformation is not already completed when the fruit is stored, and the fine flavor and aroma of the fruit are developed.

In the storage of small fruits the conditions and purposes are different. The strawberry, for example, is usually developed to the highest state of perfection when picked; the quality is not improved by further ripening, and the fruit needs to be consumed quickly. All that can be hoped for from cold storage is to preserve for a short period the attractive appearance and fine flavor of the fruit.

In commercial practice, small fruits are sometimes stored for speculative purposes. The fruit is bought when the market is low; it is stored until prices advance, and it is then sold at a profit. Owing to the extremely perishable nature of most of the small fruits, however, this must be regarded as a hazardous practice. The great bulk of small fruits held in cold storage is placed there to protect the fruits temporarily from decay until they can be placed in the hands of the consumer. Shipments of small fruits are frequently delayed in transit and reach their destination too late for the early morning market. There is often little opportunity of disposing of them until the following morning, or in case the late arrival occurs on Saturday the fruit can not be sold until the following Monday morning. Without artificial refrigeration, the fruit would deteriorate rapidly, and in many instances would become worthless before it could be sold. Under these conditions it may be saved by placing it temporarily in cold storage. An overstocked market sometimes results in the cold storing of considerable quantities of small fruits when there is a reasonable prospect for a stronger demand and better prices within two or three days.

Cold storage is now used for small fruits by many canning establishments. At the height of the season, the fruit is often received faster than it can be cared for. The surplus is then placed in cold storage to be held until it can be packed in the cans. Some of the best equipped canneries in this country are now supplied with their own cold-storage facilities.

In some sections, particularly in the Hudson River Valley of New York, small-fruit growers have built farm storage houses, cooled by ice or by a mixture of ice and salt, with a view to handling their crops to better advantage. The berries are placed in these houses as fast as picked, and held until the output of the day is ready for shipment. The fruit may be held from one day to the next before shipping, or even for a longer period if desired in the case of firm-fleshed varieties, and still reach the market in good condition. It has been found that berries cooled down before shipping will carry in better condition than they do when shipped in a warm condition.

Another phase of cold storage of small fruits that is assuming considerable importance is the freezing of the fruit for use by confectioners, bakers, and restaurateurs, the fruit being held in a frozen condition for use in ice cream, pastries, etc.

In view of the difficulties involved in storing and the long season during which fresh-picked supplies can be obtained from various sections of the country, the use of cold storage for small fruits will continue to be restricted mainly to the preservation of the fruit for a brief period when otherwise it would be lost. But in this field alone cold storage serves a very important mission, for in many of the large cities of the country great quantities of berries are annually stored for brief periods for one or more of the reasons already stated. In New York, for example, thousands of crates of berries are sometimes stored in a single day in the cold-storage houses within or near the produce district.

There is very little information published relative to the cold storage of small fruits, and such as is available is based primarily upon observation of the conditions surrounding the fruit in the cold-storage house. Little consideration appears to have been given the conditions surrounding the growing and handling of the fruit, though these conditions very largely determine the behavior of all kinds of fruits in cold storage. The only record of a systematic test of the keeping of small fruits in cold storage which has come under our observation is a report of a series of experiments performed in England in 1898. The results of this test are given in the Journal of the Board of Agriculture of Great Britain for June, 1899 (p. 85), under the title "Cold Storage of Fruit." Extracts from this article are here given:

> The board of agriculture have received from the Kent County council a report by Mr. W. P. Wright, F. R. H. S., superintendent of horticulture under the technical education committee, upon the results of experiments on the cold storage of fruit. Three cold chambers were used, each fitted with two brine walls or flat tanks placed in close proximity to the insulated sides of the chamber; through these tanks brine cooled by a carbonic anhydride refrigerating machine was circulated at any desired temperature. Each chamber was fitted with tiers of galvanized wire shelves around the sides, and the fruit was placed on these under three different conditions: (1) Exposed on the shelves, (2) enveloped in grease-proof paper, (3) surrounded or covered by cotton-wool. It was found that strawberries could be kept for at least three weeks in a temperature of 30°, but it was necessary to surround the fruit with cotton-wool, or, in the case of fruit in sieves, to place a pad of that material over the top. When this precaution was not taken, the fruit, though sound, became dull and lost the fresh, inviting appearance which is so important when it is offered for sale. Black currants kept well for ten days, after which they began to shrivel, but plumped and freshened on exposure to the air so as to be marketable. This was especially the case with black currants that had been stored in market sieves covered with a wad of cotton-wool. After a fortnight's storage, the temperature was raised from 30° to 32° F., and this seemed to give the best results. The experiments with red currants were an unqualified success, the fruit remaining perfectly sound for six weeks, and maintaining its freshness when exposed to a normal temperature for sixteen hours. Cherries covered with wool kept for a month at a temperature of 30°, and at 36° were not only sound, sweet, and juicy, but fresh and clear. After the fourth week the fruit began to wrinkle.
>
> The small fruits above mentioned, and particularly strawberries, must, it appears, be placed in store in advance of dead ripeness; when fully ripe they will keep for some time, but lose surface freshness; the fruit must be sound, and not pecked or injured in any way. * * *
>
> In concluding his report Mr. Wright observes that, in his opinion, people do not quickly weary of high-class fruit, and a longer season than at present exists could be secured for many kinds if the best quality were ensured; but, apart from this, there are periods within the season of several perishable fruits—black currants, for instance—when ability to hold the pickings over, if only for a few days, would mean securing an enhanced price.

The results of this test agree in general with the results obtained through the cold-storage experiments of the United States Department of Agriculture as to length of time small fruits may be kept in cold storage.

OUTLINE OF EXPERIMENTS IN SMALL-FRUIT STORAGE.

Since September, 1901, many problems relating to the cold storage of fruits have received attention in connection with the field investigations in pomology of the Bureau of Plant Industry. For three years of this period the small fruits have been given special attention.

In these experiments the factors affecting the keeping of small fruits in cold storage, such as the influence of soil and climatic conditions, the time of picking, the methods of handling, the types of packages, wrappers, and the temperatures in the storage house have been under investigation. The effect of cold storage on the flavor and aroma of the fruit and the behavior of the fruit when withdrawn from storage have also received consideration.

Subsequent investigations of the Bureau of Plant Industry will bear upon a number of these problems, and while the principles laid down in this publication as a result of the tests are believed to be correct, they may be modified more or less by the additional light afforded by subsequent experiments. This report, therefore, should be regarded as preliminary rather than as conclusive and final.

The principal varieties of small fruits used in the experiments are as follows: Johnson Early, Tennessee, and Gandy strawberries; Early Harvest and Erie blackberries; Miller, Kansas, and Doolittle raspberries; Lucretia dewberries; Howard Bell cranberries; Versaillaise currants, and Houghton gooseberries. From eight to twenty-four 16-quart crates of each variety were generally used in each season's test. These fruits, with the exception of the cranberries, which were obtained from a New Jersey grower, were furnished by a number of small-fruit growers in Alexandria and Fairfax counties, Virginia. The fruit was brought to Washington by wagon, all of the growers being located within 8 to 10 miles of the storage house, and was stored from four to eight hours after picking in the cold-storage department of the Center Market, at Washington, D. C.

The names of the several small-fruit growers from whom fruit was procured, and the principal varieties furnished by each, are as follows:

Brown, J. K., Alexandria, Va., Versaillaise currants, Houghton gooseberries, and Early Harvest blackberries.

Durell, E. H., Bell Plain, N. J., Howard Bell cranberries.

Leonard, David, Westend, Va., Gandy and Tennessee strawberries, and Kansas raspberries.

Sherwood, D. C., Westend, Va., Tennessee strawberries, Doolittle and Miller raspberries, Lucretia dewberries, and Erie blackberries.

Shreve, R. E. T., Westend, Va., Johnson Early strawberries.

Sprankle, W. T., Falls Church, Va., Early Harvest blackberries.

Most of the fruit used in these experiments, except the cranberries and one series of Gandy strawberries, which were grown upon clay soil, was grown upon reddish, gravelly loam soil with clay subsoil, at an altitude of a little more than 100 feet above sea level.

The fruit, with the exception of the cranberries (which were in barrels and boxes), was packed in the open-slat crates commonly used in the middle and southern berry-growing districts, and also for contrast in the closer, more compact Hallock crate used in the berry sections of Michigan and other western States. For the purpose of testing the effect of a close package, some of the fruit was also packed in paraffined paper cartons wrapped with a calendered paper jacket. Two of these packages are shown in Plate II, figure 1. During the season of 1905 some of these cartons were wrapped in heavy paraffin paper, the whole being then inclosed in the paper jacket. The effect of wrapping was also tested both by wrapping each box or basket separately in thin, impervious japanin paper and by wrapping the entire crate in heavy manila paper.

Upon arrival at the storage house, part of the fruit of a number of the pickings was delayed a few hours in the corridors before it was placed in the storage room, while the remainder was stored at once. The fruit was stored in two temperatures, namely, 36° and 32° F. Samples of each lot were held out of storage to compare with the cold-stored fruit.

THE INFLUENCE OF SOIL AND CLIMATIC CONDITIONS ON THE KEEPING QUALITY OF SMALL FRUITS.

These experiments indicate that the character of the soil may influence the keeping quality of small fruits to some extent, though the data along this line are only suggestive. Berries grown to a large size upon low, moist, clay loam, for example, usually began to break down more quickly than the same variety grown to a somewhat smaller size upon the moderately dry gravelly loam. No comprehensive test of the influence of soil types on the keeping of the fruit has been undertaken.

The keeping quality of small fruits is quickly affected by changes in climatic conditions. Berries ripening during a period when the supply of moisture is favorable for the development of sound, healthy fruit, keep better than the same variety stunted by drought or overgrown by excessive rainfall. Strawberries of the Tennessee variety in 1903 kept poorly when picked during a drought at the opening of the season, but following two days of rainy weather, which supplied a sufficient amount of moisture, the fruit kept well for seven to ten days. After eight days of rainy weather, however, the fruit was overgrown and soft when stored, and after five days in storage was worthless.

Some varieties are much more easily affected by excessive rains than others. The Tennessee strawberry, for example, will be softened and rendered almost unmarketable by a rainfall which would not seriously affect the Gandy variety.

THE INFLUENCE OF THE TIME OF PICKING ON THE KEEPING QUALITY OF SMALL FRUITS.

Small fruits designed for cold storage should be picked when well matured and fully colored, but while still in firm condition. If harvested in an immature condition the flavor is poor and insipid, as immature fruit does not develop properly after picking. This being the case, small fruits for cold storage should be practically as well matured when picked as fruit that goes directly to market for immediate consumption.

In the case of nearly all varieties of berries used in the experiments, three pickings were made for storage, the first early in the season of the variety, the second at the height of the season, and the third as late in the season as a good picking could be secured. No difference in the keeping of the fruit from the several pickings could be detected, providing the weather and other conditions were uniform throughout the season of the variety.

STORAGE HOUSE TEMPERATURES FOR SMALL FRUITS.

In these investigations considerable quantities of small fruits have been stored in duplicate lots in temperatures of both 32° and 36° F. At the lower temperature the fruit has kept in firm condition longer, was somewhat less affected by mold, and held up equally as well or better after withdrawal from the warehouse than that stored in a temperature of 36° F. Unless the fruit was stored for a period of four or five days or longer these differences did not become noticeable.

The impression held by many warehousemen and fruit handlers that low temperatures (32° to 33° F.) are injurious to berries and other quick-ripening fruits has not been borne out by these investigations. Gandy strawberries of the crop of 1903 kept twenty-one days in a temperature of 32° F. and retained their bright, attractive appearance to a remarkable degree. The condition of the fruit after twenty-one days in cold storage is shown in Plate I, *A*. Other varieties have kept equally well for a somewhat shorter period. No discoloration of the flesh of any of the varieties has occurred as a result of the lower storage temperature.

Small fruits are stored in most warehouses at temperatures ranging from 35° to 40° F. These temperatures give satisfactory results if the fruit is to be stored not longer than two to three days. If, however, the fruit is stored for a longer period of time a temperature of about 32° F. will preserve it in better condition.

THE FREEZING OF SMALL FRUITS IN COLD STORAGE.

In some of the large cities the practice of freezing small fruits for the purpose of holding them indefinitely in a frozen condition to be used in making ice cream and pastries has recently come into use to a limited extent among confectioners, bakers, and restaurateurs. Much of the fruit used for this purpose is bought when the market price is low, such as on Saturday evenings or when the market is glutted. It is hurried into cold storage and is frozen at a temperature ranging from about 5° to 12° F. This fruit is used during the normal small-fruit season, if necessary, or may be held to prolong the season for several weeks, or even months in the case of some of the small fruits. By freezing the fruit a large amount may be kept on hand, thereby avoiding the danger of a temporary shortage in the supply. Some restaurateurs who formerly made a practice of packing berries in dry granulated sugar and of holding them at a temperature of 31° to 32° F. have now given up this practice and have adopted the freezing method.

If the fruit is intended for long preservation it is usually placed in loosely covered tin cans to prevent evaporation, but if it is to be kept a short time it is frequently stored in the ordinary crates in which it is conveyed to market. In the tests of the Bureau of Plant Industry of 1904–5 Gandy strawberries were frozen and held at a temperature of 10° to 14° F. for ten months in the tight paper-wrapped cartons of paraffined cardboard already mentioned, with very little change in color and practically no shrinkage. The condition of berries that had been in storage over seven months in a temperature of 10° F. is shown in Plate I, *B*. Berries frozen in open crates at the same time evaporated and shrunk away fully one-half within a few months.

In June, 1905, strawberries of the Gandy and Tennessee varieties and Miller and Kansas raspberries were frozen and stored in different styles of packages in a temperature of 12° F. in a general freezing room containing meats, poultry, game, etc. The packages used were (1) the paper-wrapped paraffined cardboard carton shown in Plate II, figure 1; (2) the same carton with an additional heavy paraffined paper wrap over the cardboard, which with the outside paper jacket constituted a triple-thick carton; and (3) the common open slat berry crate used in this section. This fruit was still normal in appearance on January 12, 1906, except for a slight fading in the color of the strawberries and a slight shrinkage of both strawberries and raspberries in the open crates. The fruit in the closed packages was plump and attractive in appearance. The flavor of the fruit of both strawberries and raspberries in the open crates was not good. Apparently the fruit had absorbed odors from other articles in the storage room.

The flavor of the fruit in the triple box was a little better, but it had evidently been tainted through the effect of the carbon-dioxid gas exhaled by the fruit before it was solidified in freezing. The flavor of the fruit in the double-wrapped carton, however, which was not so impervious to the air, was not contaminated, and it retained much of the sprightliness and flavor of the fresh fruit. This test seems to indicate that for frozen fruit, as in the case of fruit stored at a temperature above the freezing point, the best results can be obtained by the use of a close package, provided the package is not so tight as to prevent the escape of the gases given off by the fruit after it is packed and before it is frozen.

Frozen strawberries for ice cream have been in use in a limited way by confectioners for some time, while frozen blackcap raspberries, currants, blackberries, huckleberries, and other small fruits are now being used successfully for pies and other pastries by a few restaurateurs and bakers. A large pie bakery in a central western city is successfully using frozen blackcaps, gooseberries, blackberries, currants, and huckleberries in large quantities. When made into pies the flavor of the frozen fruit is said to be practically equal to that of fresh fruit. Considerable quantities of cherries and damson plums are also frozen by this company for use in pies. Usually these latter fruits are put into the pies whole without seeding. Sometimes they are dipped in cold water to take out the frost and then are pitted. Frozen cherries and plums shrivel somewhat in baking, and are therefore not used so successfully as some of the berries. Frozen strawberries have not been used for pies to any extent, as they are likely to soften unduly in baking. Frozen huckleberries and currants can be easily and successfully held for many months. In 1905 the firm referred to above froze 14 carloads of huckleberries, using the fruit in pies for months after the fresh fruit had disappeared from the markets.

THE INFLUENCE OF THE TYPE OF PACKAGE ON THE KEEPING QUALITY OF SMALL FRUITS.

In these experiments, the Hallock crate commonly used in the berry districts of Michigan and other Central Western States was tested in comparison with the open slat crate, with flaring baskets, used throughout the berry sections of the Middle and Southern States. Baskets used in the open-slat crates are shown in Plate III, figures 1 and 3. The Hallock crate holds 16 square quart boxes, made of veneer with raised bottoms, and is a somewhat tighter package than the slat crate. A Hallock crate is shown in Plate II, figure 3. The Hallock box, shown in Plate II, figure 2, is also much tighter than the berry basket used in the eastern crate. These two crates are the standard berry packages for the eastern United States. A series of tests developed the fact that not enough difference in the tightness of the two packages exists to materially affect the keeping of the fruit in cold storage. Practically the same amount of mold developed in the fruit in one package as in the other, and neither seemed superior to the other in affecting the length of time the fruit kept.

With a view to testing the effect of a close package upon the keeping of berries in cold storage, a considerable quantity of fruit was stored in the cartons before mentioned. The carton used holds a little less than a quart, and is manufactured and used by a confectionery firm for the purpose of preserving pop corn and other confections in a dry, crisp condition. The package is a very close one, well designed for protecting the contents from contact with the air. Fruit packed in these boxes in a dry, firm condition kept well, being much less affected by mold and less tainted by storage-house odors than the fruit stored in open packages. Fruit that was damp with rain or dew when packed, however, fermented and turned brown in three or four days. A still tighter package, made by wrapping and sealing the paraffined cardboard carton in a heavy paraffined paper wrap before inclosing it in the outside paper jacket, was tested during the season of 1905. This package proved too tight; the fruit softened and had the characteristic bad flavor of fruit confined and smothered in an atmosphere of carbon dioxid.

COMPOSITION OF THE AIR IN DIFFERENT TYPES OF PACKAGES.

In order to test the comparative tightness of the several packages and to determine the effect of a close package on the air surrounding the fruit, a series of chemical tests of the air in the packages was made in cooperation with Mr. H. C. Gore, assistant chemist, in the Bureau of Chemistry. Packages of fruit were prepared in the berry field and were placed in cold storage at 36° F. two to four hours later. The packages used were the double-wrapped and the triple-wrapped cartons previously described and glass bottles with rubber stoppers. Within four to ten days after the fruit was stored Mr. Gore analyzed samples of the gases taken from the several styles of packages.

The method of taking the samples of gas was as follows: A round hole was punched in one end of the box and a glass tube was immediately inserted nearly the whole length of the box. This glass tube was connected with a rubber tube attached to a 6-ounce bottle. The bottle, rubber tube, and glass tube had been previously filled with water. By gentle suction a sample of air 60 to 80 cubic centimeters in volume was drawn from the package and was immediately analyzed. In taking samples from the bottles the glass tube of water was inserted through an opening made by removing a glass plug from the stopper of the bottle. By these methods of taking the gas samples some admixture with the outside air is possible, but it was evidently not sufficient to vitiate the results in a comparative study of this kind. Table I shows the result of these analyses.

TABLE I.—*Analyses of gas in strawberry packages.*

Variety.	Date of picking.	Date of analysis.	Volume of sample analyzed.	Character of wrapper.	Carbon dioxid found.	Oxygen found.
	1905.	1905.	*Cubic centimeters.*		*Per cent by volume.*	*Per cent by volume.*
Gandy	June 5	June 15	62.2	Double wrapper	2.09	17.5
Do	do	do	86.0	do	1.86	18.6
Do	June 9	do	73.7	do	1.49	20.0
Do	do	do	100.0	do	1.40	18.8
Do	do	do	78.2	Triple wrapper	9.8	12.8
Do	do	do	100.0	do	7.16	13.6
Do	June 16	June 19	100.0	Tightly closed bottles	37.2	0
Do	do	do	86.4	do	36.3	0.2
Do	do	do	100.0	do	37.6	0
Do	do	do	63.4	do	34.3	0
Average for tightly closed bottles					36.4	

It will be seen from the above table that the samples taken from the ordinary double-wrapped cartons show a low percentage of carbon dioxid and a high percentage of oxygen. This indicates that the double-wrapped package is not very tight, comparatively speaking, as the amount of carbon dioxid retained increases with the tightness of the package. The samples taken from the triple-wrapped carton show much more carbon dioxid and much less oxygen, indicating that the triple-wrapped package is much tighter than the double-wrapped package. The samples taken from the tightly stoppered glass bottles show a still larger percentage of carbon dioxid and an almost entire lack of oxygen, indicating a high degree of tightness. In these receptacles practically all of the oxygen in the confined air was replaced by carbon dioxid, and about 15 per cent in addition was produced by the fruit.

The flavor of the fruit in the double-wrapped boxes was very good at the time the gas samples were taken, and the berries were still firm and sound. In the triple-wrapped box the fruit had softened considerably and had a bad flavor. The fruit in the glass bottles was softer than that in the triple-wrapped boxes and the flavor was very bad. The poor flavor, together with the softening of the texture, was undoubtedly due to the smothering of the fruit by the large amount of carbon-dioxid gas.

A fruit as taken from the tree or plant is a living, breathing organism. It takes in oxygen and gives off carbon dioxid. It can not be held in a tight package in an atmosphere of carbon dioxid exhaled by the fruit itself without killing it or injuring it severely. This is apparently what occurred in the triple-wrapped cartons and in the glass bottles. However, in the practical application of a close package to fruit storage, smothering would not be likely to occur, as a package tighter than the double-wrapped box would rarely, if ever, be used. Fruit appears to be damaged little, if any, in keeping quality or in flavor by the presence of a small amount of carbon dioxid in the air of the storage room, and only in the presence of a large amount of this gas does real injury occur. Commercial packages which are generally used in storing fruit are not sufficiently tight to retain a considerable amount of carbon dioxid. There might be some injury in a moderately close package if the fruit was not stored quickly after it was picked and packed. The life processes of the fruit are much accelerated at this time, particularly in warm weather, and under these conditions enough carbon dioxid might be given off and retained by the package to injure the quality of the fruit before it was stored. In cold storage, however, the life processes are retarded quickly by the low temperature, respiration progresses much more slowly, less carbon dioxid is given off, and therefore there is less danger of injury from this source.

THE INFLUENCE OF THE WRAPPER ON THE KEEPING QUALITY OF SMALL FRUITS.

At the present time no tight berry package is manufactured. A few northern growers are using paper wrappers on berry boxes, which is a step in the direction of a close package. In the tests of the Bureau of Plant Industry impervious japanin paper was used upon a considerable quantity of fruit stored, each box being wrapped separately. Berry boxes wrapped in japanin paper are shown in Plate II, figures 2 and 3. The wrapper aided materially in retaining the bright color and attractive appearance of the fruit and prevented the absorption of storage-house odors to a marked degree. It also retarded to some extent the appearance of mold. In preventing the tainting from storage-house odors alone, the moderately tight package or the use of the wrapper has proved of great value.

During the season of 1905 a test of wrapping crates of strawberries of the Gandy and Tennessee varieties in heavy manila paper was made, the entire crate being covered with paper instead of wrapping the individual baskets. While this treatment did not result in materially diminishing the amount of mold which developed on the fruit, it did prove efficient in preventing the tainting of the fruit from storage-house odors. Berries in adjoining unwrapped packages became so contaminated with odors from other products in the storage room that the fruit was quite unpalatable in a few days, while the berries in the wrapped crates remained entirely free from such contamination.

Aside from the protection afforded berries by its use, the wrapper also adds to the attractiveness of a berry box. The idea of rendering the package more attractive has probably been the dominating one with the berry growers who have made use of the wrapper, but, as previously shown, its usefulness does not end with its esthetic value.

In commercial cold storage, single rooms in storage houses are frequently used for a wide range of commodities during the summer months. It is not uncommon to find vegetables of various kinds and even citrus fruits stored in the same room with berries. In a poorly ventilated room, the odors arising from these products are quickly absorbed by the berries, rendering the flavor of the fruit objectionable. The fruit lacks wholesomeness, and is therefore objectionable to the consumer, though it may be bright in color and of sound physiological condition.[a]

THE INFLUENCE OF OXYGEN GAS ON THE KEEPING QUALITY OF SMALL FRUITS.

As the keeping quality of the small fruits was injured when they were stored in an atmosphere containing an excess of carbon dioxid, some tests were made by Mr. Gore to determine the influence of storing strawberries and raspberries in an atmosphere containing an excess of oxygen.

The strawberries used for the test were of the Gandy variety. A few berries were soft when stored, but most of the fruit was firm and dry. Several boxes were exposed to the usual conditions of the open package, and several were kept in a large glass bell jar, which closely fitted a ground glass plate. The air in this jar was then displaced with oxygen of 90 to 95 per cent purity, and was renewed at intervals of two to four days throughout the experiment. After an interval of sixteen days the jars were opened and the fruit compared with that stored in the exposed boxes.

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[a] The factors that influence the wholesomeness of a fruit in cold storage are complex in nature. It is generally supposed that good quality is determined principally by the length of time the fruit has been stored. The question, however, is more complicated than this. The physical condition and flavor of the fruit at any period in its storage life may be influenced by the weather conditions surrounding it before it is stored or by a delay in storing the fruit, both of which may cause it to expend a large part of its life before it is stored; they may be modified by the relation the package or wrapper bears to the proper ventilation of the fruit or to the exclusion of the impure air of the storage house; they may be modified by the rapidity of cooling the produce after it is placed in the warehouse, by the relation of the storage-house temperature to the life processes of the fruit, by the ventilation of the warehouse, and finally by the effect of the length of time the fruit is in storage on all of these factors. Until recently little attention has been paid to the factors that affect the wholesomeness of cold-storage fruits, except the length of time a product is stored and the temperature in which it is stored in the warehouse. The work of the Bureau of Plant Industry along fruit-storage lines has emphasized the fact that the question is much broader than is generally believed and that it needs careful experimental consideration from several standpoints.—G. H. P.

The fruit held in oxygen had a good color and flavor, but had softened so as to be entirely unmarketable. It was free from black mold. The fruit held in open boxes had a good color, but a bad flavor, and it was badly molded. It was unmarketable. The difference between the two lots was about that which occurs when the fruit is stored for the same length of time in open and closed packages. No effect due primarily to the oxygen gas was apparent.

For the raspberry test, Kansas blackcaps were used. The fruit was in first-class condition, dry and firm, when stored. Several boxes were left under the usual storage conditions, several were kept in a bell jar in confined air, and several were kept in a bell jar in oxygen, the gas being frequently renewed. After an interval of thirty-nine days the fruit was examined. The berries in the open boxes had sunk down so that they filled the boxes not more than half full. They had molded badly. The fruit confined in air in the bell jar was in good physical condition. The berries were dry and free from mold. The flavor, however, was insipid. The fruit kept in oxygen was also in good physical condition. The berries were dry and free from mold, but the flavor was quite insipid. No effect attributable to the presence of oxygen was brought out. As in the case of the strawberries, the better condition of the inclosed fruit over that of the exposed fruit was due apparently to the influence of the close receptacle.

THE INFLUENCE ON THE KEEPING QUALITY OF CAREFUL HANDLING AND OF STORING SMALL FRUITS SOON AFTER PICKING.

The most serious troubles with small fruits in cold storage are the quick loss in flavor when they are stored in impure air, the softening of the fruit from overripeness, and the molding or decay, especially of raspberries, strawberries, blackberries, dewberries, and currants. The mold usually appears a few days after the fruit is stored. It is a fungus called *Botrytis vulgaris*, commonly known as black mold. Molded berries are shown in Plate I, *D*, and in Plate III. It is especially serious in small fruits that have been handled roughly and that are not stored soon after picking. A berry picked in a dry, sound, firm condition is not often attacked by the black mold. Overripe berries and berries with the surface bruised nearly always mold. The mold gains entrance through the bruised or weakened parts of the fruit, creeping over the berries in the form of a cotton-like covering or mycelium. It grows luxuriantly in warm temperatures and slowly in the coldest temperatures in which the fruit can be stored safely without freezing. It is most troublesome on raspberries.

The most successful method of preventing this trouble is to store only sound, firm berries. To prevent the trouble is primarily a problem of picking and handling. It is necessary that the pickers do not injure the berries, and that they be handled through every operation from the crating to the market with enough care to prevent the bruising of the delicate fruit. A large proportion of the commercial losses in the shipping and handling of small fruits is the direct result of the rough handling which makes them susceptible to mold or decay.

In addition to the loss from mold, the bruised portions of small fruits quickly discolor in the storage house, as shown in the frontispiece, Plate I, *C* and *D*.

Quick storage or cooling after picking is an equally important requirement in small-fruit storage. The life processes need to be checked at the earliest possible moment to prevent overripeness and to conserve the flavor of the fruit by preventing the giving off and accumulation of carbon dioxid and the absorption of odors from the surrounding air. The fruit needs to be cooled quickly, also, to retard the growth of the molds already mentioned. If the fruit stands in the field or in a packing house or at a railroad station for some time before loading, if it is hot when loaded and is shipped by express or by freight without ice, if it is not cooled down quickly in the car when shipped in refrigeration, or if the fruit is held in the market for some time after arrival it is impossible to place it in cold storage without the subsequent development of bad flavor, overripeness, and moldy or decayed fruit.

THE LENGTH OF TIME SMALL FRUITS KEEP IN COLD STORAGE.

The length of time small fruits keep in cold storage depends upon the variety, the conditions under which the fruits are grown, and the methods of handling them in picking, packing, shipping, etc. In the Department tests, with fruit handled under good commercial conditions, strawberries kept from one to two weeks in good condition so far as appearances were concerned, but the flavor usually began to deteriorate after three or four days. Some of the firm-fleshed varieties, like Gandy, kept even longer than two weeks when picked dry and carefully handled, while tender varieties, like Tennessee, went down much more quickly. Red raspberries usually began to mold after two or three days in storage. Black raspberries kept in sound condition for a somewhat longer period. Most varieties of blackberries kept a week, while some of the firmer fleshed sorts kept several days longer. Dewberries behaved similar to blackberries. Currants kept well for two weeks with slight loss of flavor. Gooseberries retained their normal appearance and flavor for two to three weeks, after which the fruit turned red and became unsalable. Cranberries kept throughout the winter and were withdrawn the last of April in good commercial condition.

These statements are based upon tests with small fruits packed in the customary way as for market and stored in a temperature of 32° F. Wrapped fruit and fruit stored in moderately tight packages kept for somewhat longer periods.

THE BEHAVIOR OF SMALL FRUITS WHEN WITHDRAWN FROM COLD STORAGE.

Small fruits do not hold up long after withdrawal from cold storage on account of their highly perishable nature. In the tests of the Bureau of Plant Industry strawberries, raspberries, and blackberries which had been stored for several days usually began to break down within six to sixteen hours after removal from storage, while currants and gooseberries held up from twelve to twenty-four hours, or even longer.

Small fruits need to be placed in the hands of the consumer as quickly as possible after removal from cold storage. If disposed of quickly after withdrawal, small fruits which have not been stored too long or subjected to unfavorable conditions in handling or storing will be in wholesome condition about as long as fruit in similar condition of ripeness and soundness that has not been in cold storage.

SUMMARY.

Cold storage has not exerted so important an influence upon the development of the small-fruit business as upon the growing of apples, pears, and other tree fruits. Small fruits are not adapted to keeping for any length of time in cold storage.

Most of the small fruits are held in cold storage to protect them from decay, usually not more than two or three days, until they can be placed in the hands of the consumer.

Nevertheless cold storage is a factor of no small importance in the handling of the small-fruit crop. Shipments of small fruits reaching destination too late for the early morning market are usually placed in cold storage until the following morning. Large quantities of small fruits are stored for two or three days when the markets are glutted and when prospects are good for an advance in prices. Many canneries are equipped with cold storage plants for use in preserving berries and other fruits until they can be utilized. In some sections small farm storage houses are used in connection with the handling of small fruits. Small fruits are sometimes stored in a frozen condition for weeks and even months for use by confectioners, bakers, and restaurateurs.

Berries grown to a large size upon low, moist soil usually begin to break down more quickly in cold storage than the same varieties grown to a somewhat smaller size upon light, dry soil.

Berries ripening during a period when the supply of moisture is favorable for a sound, healthy development of fruit keep better than the same varieties stunted by drought or overgrown on account of excessive rainfall.

Small fruits designed for cold storage should be picked when well matured and fully colored but while still firm.

There is no apparent difference in the keeping of small fruits from early, medium, and late pickings.

Small fruits must be handled quickly and with great care in the field and on the way to the storage house to prevent ripening, the bruising of the fruit, and the development of mold.

If the fruit is to be stored for two or three days, a temperature of 36° to 40° F. will ordinarily give satisfactory results, though a temperature of 32° F. is to be preferred. If the storage period extends over a week or more, a temperature of 30° to 32° F. will be found more effective.

When frozen for long keeping, small fruits are usually subjected to a temperature of 5° to 12° F.

Frozen strawberries to be used in ice cream have been in use in a limited way by confectioners for some time, while frozen raspberries, currants, blackberries, huckleberries, and other small fruits are now used successfully for pies and other pastries by a few restaurateurs and bakers.

Strawberries and raspberries were stored in close paper cartons lined with paraffined cardboard. Some of these cartons were made extra tight by the use of a paraffined paper wrap placed over the card board liner of the carton. The cartons without the extra wrap preserved the fruit in good, sound condition, freer from mold and tainted less by storage-house odors than fruit stored in open packages. With the extra wrap the cartons proved too tight; the fruit softened and had the characteristic bad flavor of fruit confined in an atmosphere of carbon dioxid.

Wrapping baskets of berries in thin impervious paper aids materially in retaining the bright color and attractive appearance of the fruit, prevents the absorption of storage-house odors to a marked degree, and retards to some extent the appearance of mold.

Strawberries were kept in good condition in cold storage from one to two weeks; red raspberries, two to three days; black raspberries, three to five days; blackberries and dewberries, from a week to ten days, and currants, two to three weeks. Cranberries kept all winter.

Strawberries, raspberries, and blackberries which have been stored for several days usually begin to break down within ten to twelve hours after removal from storage, while currants and gooseberries hold up from twelve to twenty-four hours longer.

Upon removal from cold storage small fruits should be placed in the hands of the consumers as soon as possible.

108

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PLATES.

DESCRIPTION OF PLATES.

PLATE I. *Frontispiece.* Gandy strawberries. *A* shows the condition of the fruit after twenty-one days in cold storage at a temperature of 32° F. The fruit was firm, bright, and normal in appearance on withdrawal from the storage house, but the flavor was gone. *B* shows the condition of the fruit after more than seven months in cold storage in a frozen condition at a temperature of 12° F. *C* shows the discoloration of the fruit from bruising. *D* shows mold growing over a bruised spot.

PLATE II. Packages and wrappers used on berries in cold storage. Fig. 1.—Cartons in which berries were frozen. Fig. 2.—Strawberries wrapped with japanin paper and a box of unwrapped fruit. Fig. 3.—Black raspberries in a Hallock crate, unwrapped and wrapped with japanin paper.

PLATE III. Black mold on strawberries and black raspberries in cold storage. Figs. 1 and 2.—Black raspberries showing mold in cold storage. Figs. 3 and 4.—Black mold on strawberries in cold storage. The white mycelial threads holding the berries together and spreading over them are shown.

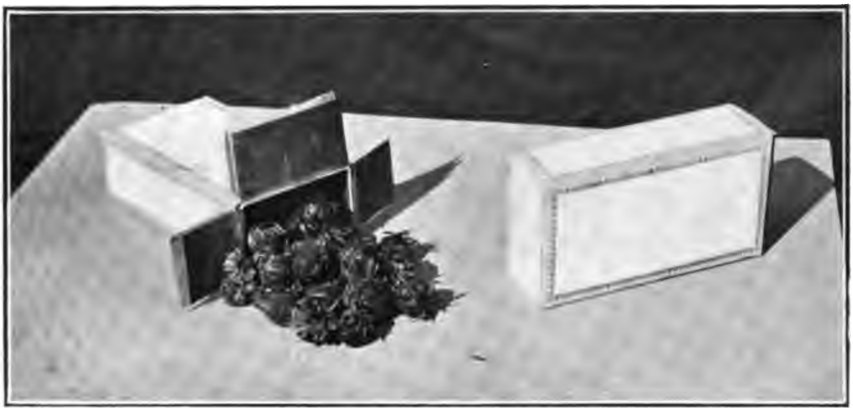


FIG. 1.—CARTONS IN WHICH FRUIT WAS FROZEN.

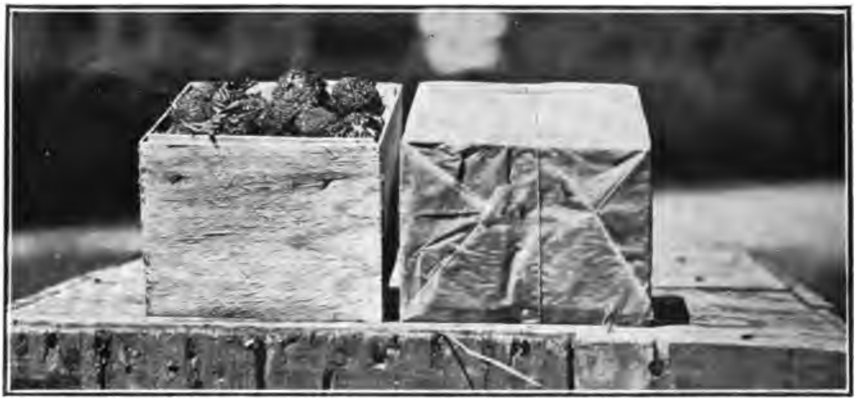


FIG. 2.—A BOX OF STRAWBERRIES WRAPPED WITH JAPANIN PAPER AND ONE UNWRAPPED.

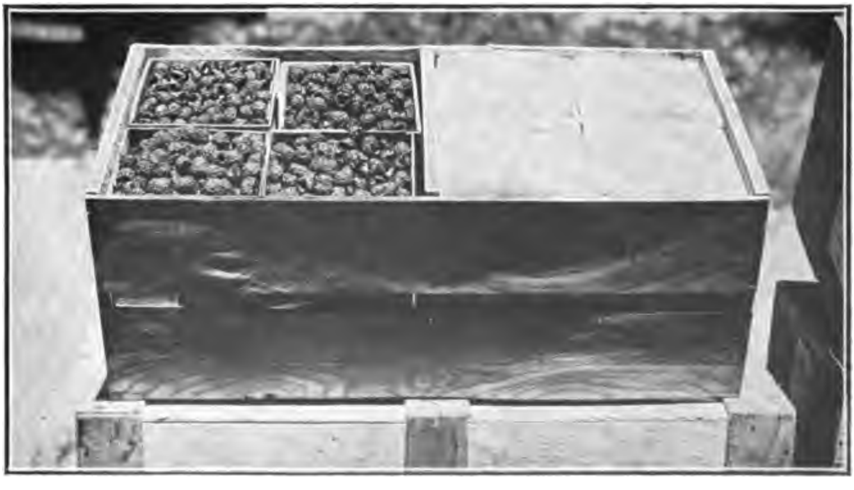
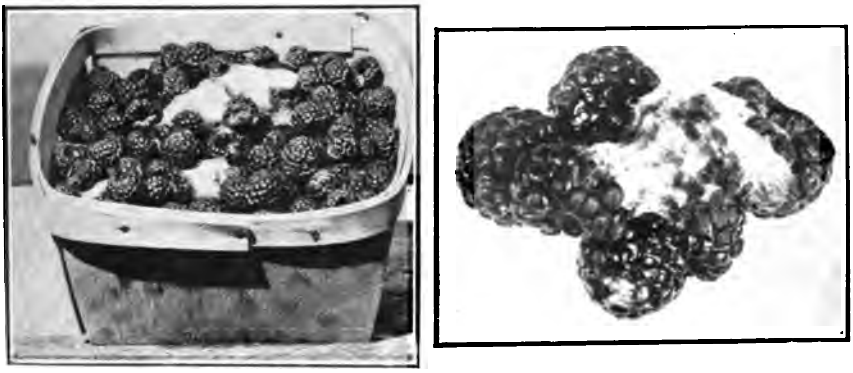
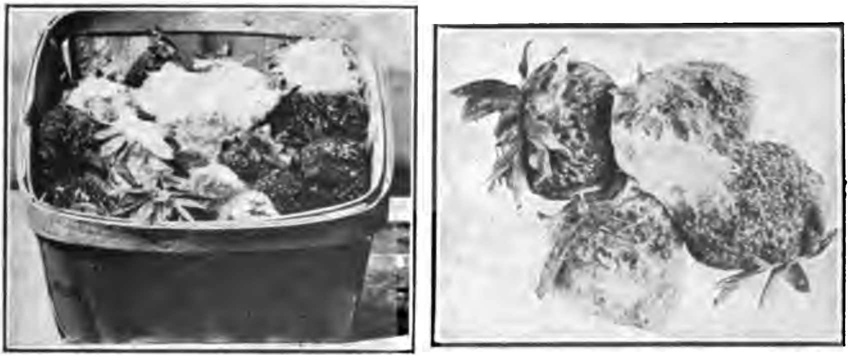


FIG. 3.—BLACK RASPBERRIES WRAPPED IN JAPANIN PAPER AND UNWRAPPED, PACKED IN A HALLOCK CRATE.

PACKAGES AND WRAPPERS USED ON BERRIES IN COLD STORAGE.



FIGS. 1 AND 2.—BLACK MOLD ON BLACK RASPBERRIES.



FIGS. 3 AND 4.—BLACK MOLD ON STRAWBERRIES.

BLACK MOLD ON STRAWBERRIES AND BLACK RASPBERRIES IN COLD STORAGE.

INDEX.

Page.

Air in different types of packages, composition ... 15–17
Behavior of small fruits when withdrawn from cold storage ... 21
Blackberries, varieties tested in storage ... 10
Black mold, cause ... 19
Botrytis vulgaris, cause of black mold ... 19
Canneries equipped with storage houses ... 8, 21
Carbon dioxid, injurious effects in sealed packages ... 15
Cartons used for berries in storage tests ... 11, 15
Climatic conditions, influence on keeping quality of fruits ... 11
Cold storage of different fruits, purposes ... 7
Cranberries, varieties tested in storage ... 10
Crates, kinds used in storage tests ... 11, 14–15
Dewberries, varieties tested in storage ... 10
Evaporation, methods of overcoming, in freezing fruits ... 13
Experiments outlined ... 10–11
Farm storage houses used for small fruits ... 8
Flavor, absorption of storage-house odors, methods of control ... 17
    frozen fruits, influence of package ... 13–14
    stored fruits, influence of tight package ... 16
Freezing fruits for use by confectioners and bakers ... 8, 13–14
        methods of overcoming evaporation ... 13
Fruits, frozen, flavor, methods of control ... 17
        influence of package on quality ... 13–14
        length of storage ... 14, 20
        purposes ... 7
        temperature during storage ... 12–14
        used by confectioners and bakers ... 13–14
    in farm storage houses ... 8
    keeping quality, influence of careful handling ... 19–20
            climatic conditions ... 11
            oxygen ... 18–19
            size of berry ... 11
    kinds tested in storage ... 10
Gases in sealed packages of berries, composition ... 15–17
Gooseberries, varieties tested in storage ... 10
Great Britain, report of fruit storage test in 1898 ... 9
Handling, careful, influence on keeping quality ... 19–20
Keeping quality, behavior after storage ... 21
        controlling factors ... 10
        influence of careful handling ... 19–20
            oxygen gas ... 18–19
            storing soon after picking ... 19–20
            type of package ... 14–15
            wrapper ... 17–18
27

Page.
Maturity, degree best for storage 12
New York, extent of small fruits stored 8
Oxygen, influence on keeping quality of small fruits 18–19
Package best suited for freezing fruit 13
  gas surrounding fruit 15–17
  kinds used in storing small fruits 11, 14–15
  sealed, for freezing berries, effect 15
Paper, japanin, for wrapping fruit 11
  paraffin, for wrapping fruit 11
Plates, description 26
Quality, behavior after storage 21
  keeping, controlling factors 10
    influence of careful handling 19–20
    climatic conditions 11
    oxygen 18–19
    size of berry 11
  methods of preserving, in storage 17
  retention in storage 20
  storage-house odors, influence 17
Raspberries, varieties tested in storage 10
Size of berry, influence on keeping quality 11
Soils, influence on keeping quality of small fruits 11
  kinds on which fruit tested was grown 11
Storage, cartons used for berries in tests 11, 15
  crates used in tests 11, 14–15
  duration for different small fruits 14, 20
  prompt, importance for best results 19–20
  temperatures 12–14
  varieties of small fruits tested 10
Strawberries, varieties tested in storage 10
Summary 21–23
Temperature best for ordinary storage 12
    freezing storage 13
Time small fruits keep in cold storage 20–21
Varieties of small fruits tested in storage 10
Wholesomeness of stored fruits, factors influencing 18
Wrappers for small fruits, kinds tested 11

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